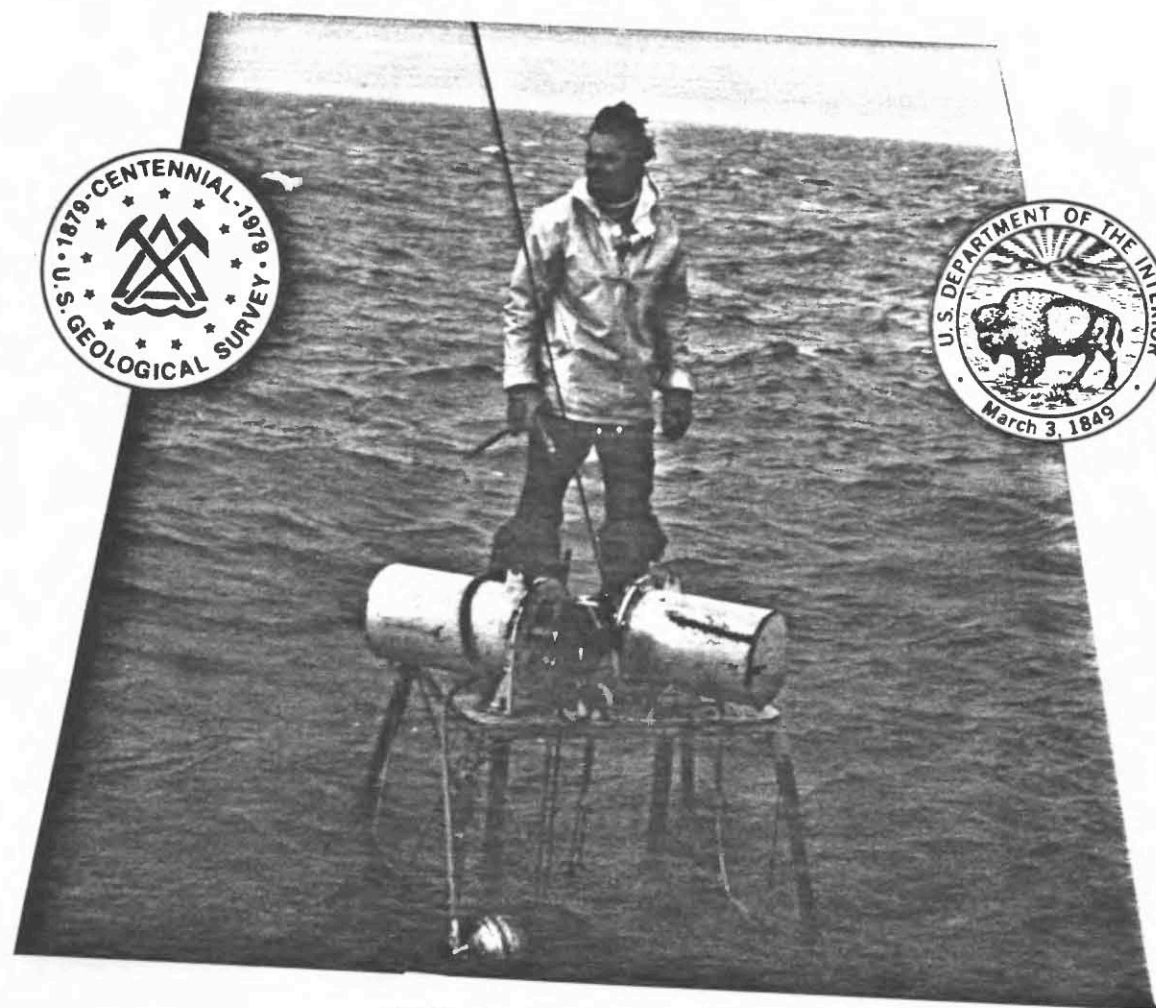


UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CORE DESCRIPTIONS AND PRELIMINARY OBSERVATIONS OF
VIBRACORES FROM THE ALASKAN BEAUFORT SEA SHELF



OPEN-FILE REPORT 79-351

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with Geological Survey standards and nomenclature

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Core Descriptions and Preliminary Observations of
Vibracores from the Alaskan Beaufort Sea Shelf

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INTRODUCTION

Interpretation of modern sedimentary environments requires an understanding of sub-seafloor sedimentary character. This is especially true on the arctic shelves where ice gouging actively influences sediments to depths of a meter or more on an annual basis such that surficial sedimentary parameters do not entirely reflect ongoing geologic processes. Knowledge of substrate character is also a precondition for safe and efficient offshore development activities.

Preliminary insight into substrate character was obtained using a vibratory coring device to obtain cores up to 180 cm in length at 60 locations on the inner Beaufort Sea shelf. Locations were chosen from several different geologic environments. Three of these environments could be crudely characterized.

This report provides the marine geologist and soils engineer with the field and laboratory methodology used and a preliminary interpretation of sedimentary environments together with descriptions, sketches, photographs and radiographs of the cores. A general treatment of the shelf sedimentary environment is not given here. The interested reader is referred to articles by Reimnitz and Barnes (1974), Barnes and Reimnitz (1974), Lewis (1977), and Reimnitz and others (1977) for this information.

In the first section of this report we describe the coring procedures and methodology used in processing the cores. This section is followed by preliminary discussion of the sedimentary environments illuminated by the cores. The data, in the form of core descriptions, is contained in the appendix.

METHODS

Field Techniques

The samples described in this report were obtained using a vibratory corer. Vibrations are generated from the forces created when a pair of electrically driven, counter-rotating, eccentric weights in the core head drives a hammer against an anvil. The hammer impact from the downstroke is repeated 2,840 times per minute transmitting 700 kp of force at each stroke through the driving head to the 2-meter core barrel. The repetitive blows and the weight of the driving head force the barrel into the sediment. The vibrating head and core barrel are guided into the sediment by a bottom-resting quadruped frame with vertical rails. This same frame supports penetration and inclination measuring devices and a winch which withdraws the core barrel from the sea bed after sampling. The configuration and dimensions of the corer are shown in Figure 1.

Two types of core barrels were used - 10 cm x 10 cm boxes of sheet metal and 10.8 cm round fiberglass tubing. The steel barrels propagated the hammer vibrations to the sediment more efficiently and therefore generally obtained longer cores. Spring type core catchers were necessary in both barrel shapes to retain sand and gravel samples.

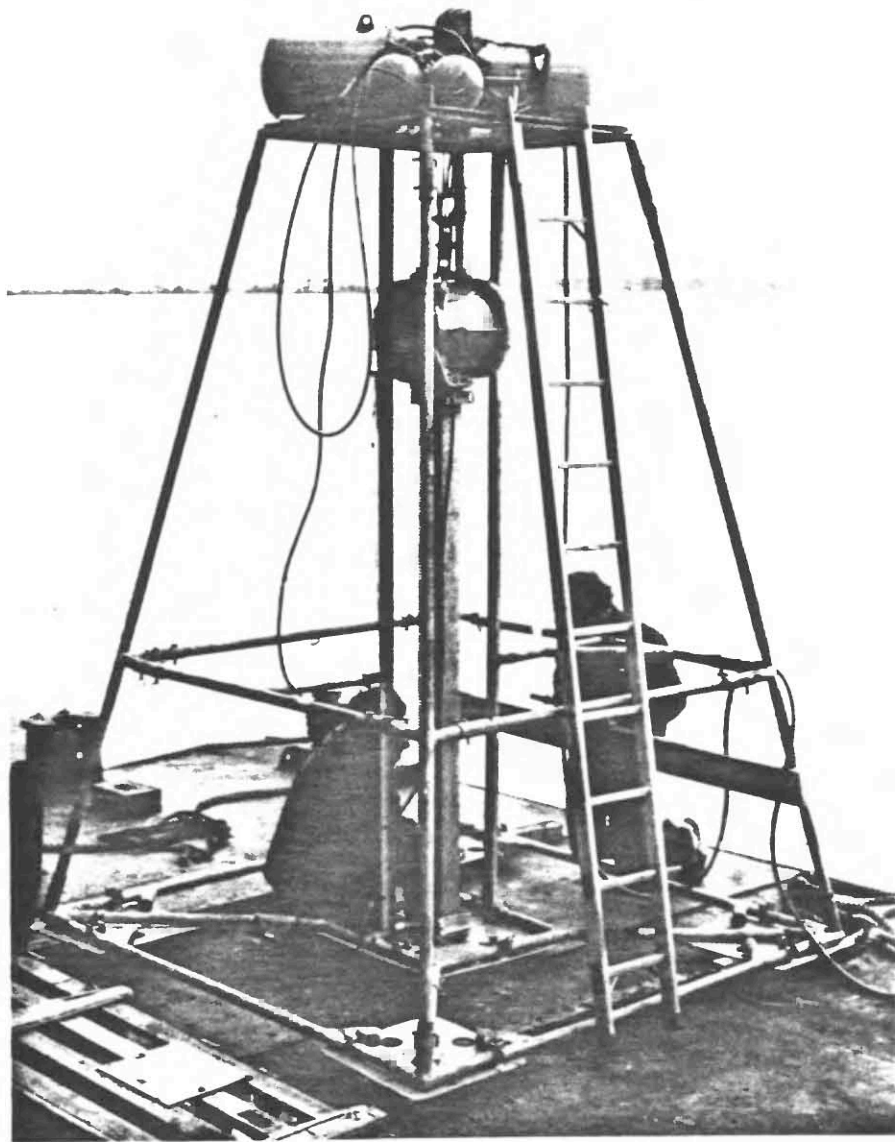


Figure 1. Vibrocorer used in this study. The overall height of the corer is 3 meters. The cylindrical housing atop a square core houses the vibrator barrel, which is guided into the sediment by the T rails on either end of the cylinder. The two cylindrical housings on the top of the corer contain the winch for withdrawing the core barrel and control electronics.

The coring procedure at each sample site in both 1976 and 1977 was essentially the same. The vessel used for this sampling, the Geological Survey's R/V KARLUK, was anchored from the bow at each site, corer was lowered over the starboard quarter, as shown in Figure 2. After the core frame had settled to the sea floor, the vibrators were operated for 3-minute increments alternating with 20-minute cooling intervals, until either full penetration was indicated or further penetration was unlikely. Vibrating times ranged from less than 3 minutes to a maximum of 10 minutes. In 1976, incremental times and penetration depths were recorded for determining the rate of penetration. The implications of varied penetration rates observed at each coring site are discussed in a report by Reimnitz and others (1977). Several sedimentary environments were chosen for the sampling program including bays, lagoons, ice gouge terrain, delta front platforms, shoals, and islands, as shown in Figure 3.

Laboratory Techniques

After retrieval the cores were capped and shipped for storage in Menlo Park. In 1976 the cores were capped at the lower end and sealed at the top with plaster-of-paris or paraffin, while in 1977 the top seal was made with a chemical grout gel. The cores were stored at 4°C prior to analysis.

Within 4 months of sampling the cores were opened and processed. The cores in the metal barrels were accessed by removing screws on diagonally opposite edges of the metal boxes. Fiberglass barrels were cut lengthwise twice, 180° apart, using a circular saw. After the core



Figure 2. The U.S. Geological Survey's research vessel KARLUK anchored, ready to lower the vibrocorer to the sea floor.

was exposed by removal of half of either the metal or fiberglass barrel, the sediments were split lengthwise with a fine, taut wire. The core halves were then separated. The wire-cut face of one half of the core was then inverted onto a plexiglass sheet and a 1 cm slab was sectioned from the center of the core with the taut wire. This 1 cm slab was used for radiography. The remaining segment of this core half was ultimately archived in plastic at 4°C along with the 1 cm slab cut for radiography. X-rays were generated at 50 kv and 3 to 5 ma were used to expose type M or AA film for maximum radiographic contrast. Exposure times of 10 to 15 minutes were needed.

The wire-cut face of the other core half was used for photography, description, and sediment peel. Freshly cut moist surfaces were photographed with black and white film prior to oxidation of the sediments. This surface was then used to create a detailed description and sketch of core textures and structures. Subsequently this half of the core was impregnated with resin, following the techniques outlined in Burger and others (1969), resulting in a sediment peel. The peel technique worked well in sandy sediments, enhancing the sedimentary structures; but was unsuccessful in preserving or emphasizing structures in finer grained materials. After samples for paleontologic and dating purposes were removed, the remainder of this core half was dried, cut into 5 cm sections and stored in envelopes for future analysis.

OBSERVATIONS AND DISCUSSION

A wide variety of sediments were recovered in the cores including gravels, sands, clays and fibrous organic matter. In some cases all the textures were represented in one core. The textural variety is in

keeping with the patchiness of surficial sediment character noted during diving traverses (Reimnitz and Toimil, 1977). The lack of vertical and lateral continuity of textural units attest to the complexity of processes affecting this shelf environment. On the other hand, characteristic associations allow us to distinguish three environments, even when the processes involved in the generation of these environments remain unclear.

Delta Front Platform

Well-stratified sediments with abundant fibrous organic matter are distinctive of the delta front platform cores. These characteristics are seen in cores obtained in water depths less than 4 meters off four rivers of vastly different sizes. The Colville River (Cores 18 to 23, and 56 to 60; appendix and Figure 3); the Kuparuk River (Core 27); the Sagavanirktok River (Cores 30 and 31) and the Putuligayalik River (Core 26). Delta cores commonly contain bedded and cross-bedded clean sands especially inshore of the 2-m isobath. On the Colville delta where the largest number of samples were taken, organic material is more abundant in cores close inshore and in cores from the western delta. No layers of fibrous organic material are seen in cores seaward of the delta front platforms. Two additional features are conspicuous of delta cores. Coal is a common coarse fraction component. Conversely, gravels of any size are completely absent. The sedimentary environment and resulting structures of the delta front platform reflect the character of the arctic rivers of Alaska. Along the arctic coast a submarine bench is commonly developed at 2 meters off the mouths of rivers (Fig. 3). This so-called 2-m bench has a dramatic influence on the introduction of

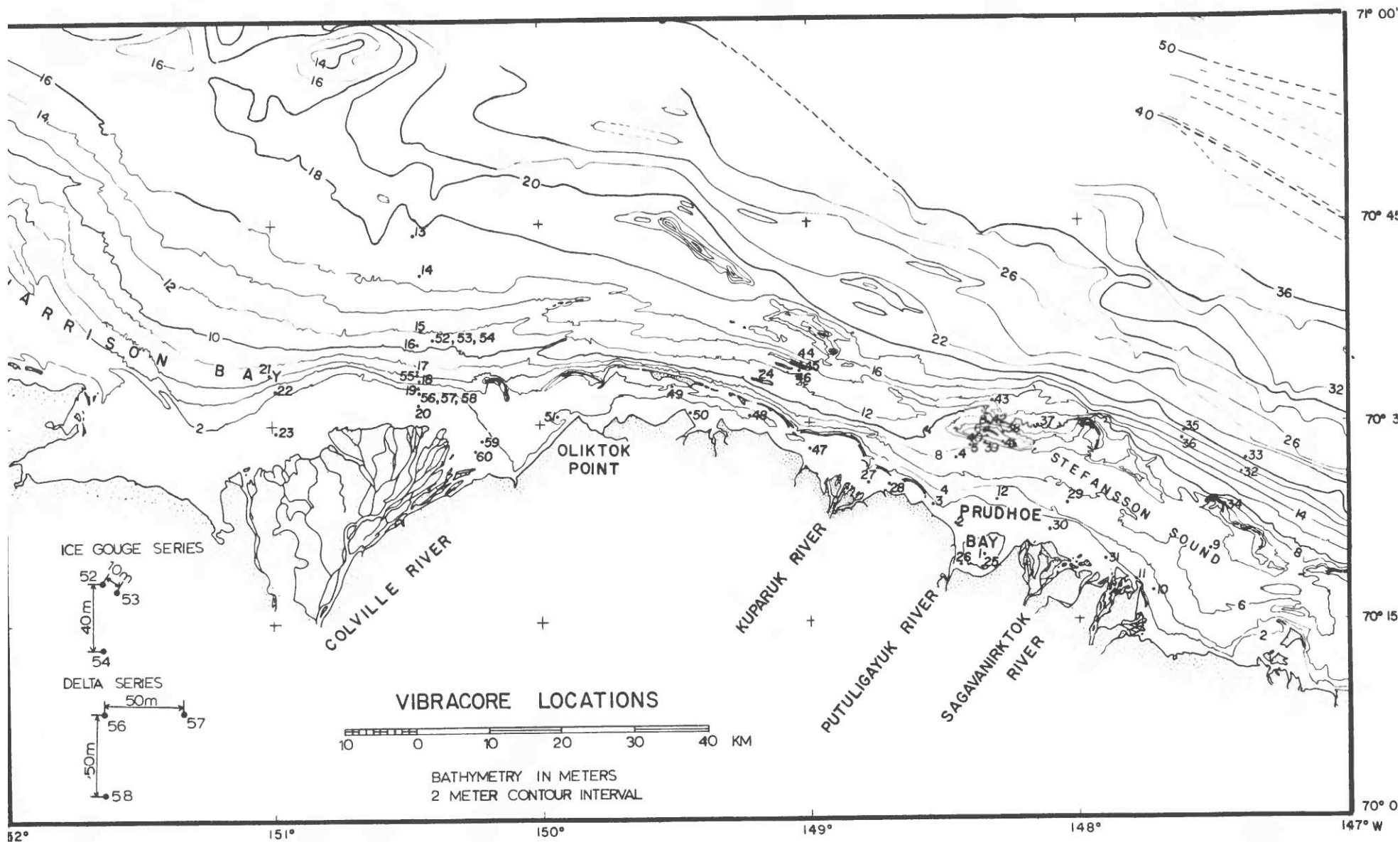


Figure 3. Bathymetry map showing the location of vibrocores taken in 1976 and 1977. Note the location of the "2-m bench" of the Colville and Sagavanirktok Rivers, the location of the cores seaward of the Colville delta in ice gouge terrain and the location of core in the vicinity of the barrier island directly north of Prudhoe Bay.

detrital material during the spring river flood which precedes the melting and breakup of sea ice. Spring melting within the river drainage basins occurs from the top down in the sequence: snow, tundra organics, and tundra soils. Organic material is the first detritus available for stream transport. Thus initially organic rich waters flood the sea ice off river mouths. Initial drainage of the flood waters occurs at strudel, seaward of the 2-m bench, ultimately flowing offshore (Walker, 1974). Within days the ice lifts from the sea bed inside the 2-m bench and melts from the influx of warmer river water. As melting of the sea ice proceeds, more and more of the flood waters are confined to the 2-m bench by remaining sea ice farther offshore. During this time the resulting input of organic and mineral detritus is more or less constrained to the 2-m bench, which is sheltered from waves by ice.

The intensity of the hydrologic processes of the subsequent open water season along the arctic coast would be important in determining the likelihood of peat preservation on the delta front. As the prevailing winds are from the northeast, the western portions of the deltas are more protected from wave action by shoal water upwind. This, coupled with dominant longshore drift to the west, indicates that more abundant peat deposits should be expected on the western parts of the deltas.

Flood water drainage at strudel generates circular scour depressions in the bottom disrupting the continuity of sedimentary units (Reimnitz and others, 1974). At least four of the delta cores penetrated deposits that represent strudel scour infilling. The

inclined lamination in Cores 18, 10, 11, and 30 are the result of scour infilling from the steep sides of the scour depressions. Similar steeply dipping depositional slopes have been observed on the sides of strudel scour depressions during diving studies.

A series of three cores (56, 67, and 58), taken within 50 m of each other, demonstrate the lateral discontinuity of sedimentary units on the delta front platform. In the upper 50 cm of the cores, thickness and character of the sedimentary units varied considerably, yet correlation was reasonable. Below 50 cm correlation was uncertain to impossible. Thus the preservation of depositional units with lateral continuity in excess of tens of meters must be rare on the delta front platform.

Areas Reworked by Ice

Seaward of the delta front platform and the barrier islands the seabed in areas exposed to vigorous ice action reflects surficial reworking due to ice gouging (Reimnitz and Barnes, 1974; Barnes and others, 1978). The vibracores from this environment (Cores 13 through 16, 43, 44, and 52 through 54), exhibit a different character. The sediments are finer grained with occasional shells and pebbles. Horizontal bedding in general is poorly developed, although well defined sand layers occur.

The lateral variability of sedimentary character is seen in three cores (52, 53, and 54) taken within 40 m of each other in an area where ice gouging is known to be an ongoing process (Barnes and others, 1978). The depositional units are similar in all three cores - alternating beds of slightly sandy muds and well-laminated, clean sands. The upper contacts of the mud units are generally erosional while the low contacts

appear bioturbated and possibly depositional, although not gradational. Core stratigraphy cannot be correlated from one core to another. The predominance of horizontal bedding features in all of the cores was not expected in an area where ice gouging is common (Barnes and Reimnitz, 1974).

Studies indicate ice should essentially rework the bottom sediment to an average depth of 20 cm in less than 200 years (Barnes and others, 1978, p. 35). As rates of sedimentation are estimated at less than 10 cm per 100 years (Reimnitz and Barnes, 1974, p. 330), we would expect the entire core, where ice gouging is prevalent, to be completely reworked. The existence of numerous undisturbed sand layers is therefore puzzling. If sedimentation rates within ice gouges are much greater than on gouge flanks and intergouge areas, thereby allowing the horizontal bedding in the deeper gouge incisions to be preserved, the enigma could be explained.

Barrier Islands

Cores taken in the vicinity of the sand and gravel islands (Cores 5 through 8 and 38 to 43) indicate that the island environment is dominated by laminated clean sands with cross bedding and with rare pebbles. Close inshore to the island on the seaward side sands are associated with gravels and pebbly sands. Further offshore, sands are associated with mud lumps, gravel is not present, and the sands are more or less well bedded. Ice gouging is responsible for the poorly developed bedding observed in some offshore cores. Outcrops of pre-Holocene stiff silty clay observed on diving and side-scan sonar observations in the area (Reimnitz and Toimil, 1977) are the source

areas for the numerous mud lumps encountered in the offshore cores on the seaward side of the island.

Other Environments

Cores recovered from other modern sedimentary environments are not diagnostic. Samples from lagoons and bays (Cores 1, 4, 9, 12, 14, 18, 19, and 47-50), on the whole, reflect a quiet sedimentary environment with finer grained sediments, organic debris, and evidence of more biologic activity than is seen in cores from deltas, ice-gouged areas, or barrier islands. However, the influence of local conditions is also apparent: sands and gravels from nearby islands, local outcrop material, effects of strudel scour, or ice gouging.

The series of four cores from the ridge environment northeast of Oliktok Point (Cores 24, 44, 45, and 46), indicates that the ridges are formed of sands with gravels at the toes. The flank cores are not diagnostic of lag or source materials. Therefore we believe that at the present time sample size is insufficient to characterize these features.

We attempted to obtain a set of cores from the sea floor under the stamukhi zone where our bathymetric and seismic records indicate a pronounced sedimentologic change (Reimnitz and Barnes, 1974, p. 332, Fig. 27). Of four attempts, only one (Core 35) was successful. This sample consists of a highly compact gravelly clay without stratification. At the other three sites the corer would not penetrate into the sea floor sufficiently to retain a core.

SUMMARY AND CONCLUSIONS

Based on core descriptions of sixty core sites on the Beaufort Sea inner shelf, three sedimentary environments can be crudely characterized.

1. A delta front platform environment consisting of well bedded sequences of sands, muds and peats with a notable absence of gravel.
2. An ice gouge environment consisting of sequences of structured and unstructured sands and muds.
3. A barrier island environment composed primarily of well bedded clean sands with minor amounts of gravel.

Several other morphologic environments are not readily characterized. Extreme variability in the lateral continuity of sedimentary units is also characteristic. Diversity of textural and structural features together with compositional differences preclude rapid interpretation.

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APPENDIX OF CORE DESCRIPTIONS

EXPLANATION

1. The 1976 vibracores (v1-v24) are presented on a single page which includes the core description, a centimeter scale, a sketch of the core, a photograph of the core peel, and a radiograph of the core. Penetration records have been included when available. The penetration records indicate whether the square steel barrel (□) or the circular, fiberglass barrel (O) was used during coring.

2. The 1977 vibracores (v25-v60) are presented on two pages. One page contains a photograph of the wet core, a centimeter scale, a photograph of the core peel, and a radiograph of the core. The second page includes the core description, a centimeter scale, and a sketch of the core. Shear vane measurements were obtained when possible from the tops and bottoms of the cores immediately after recovery. The device and technique used followed that outlined by Dill and Moore, (1965).

3. Layers of organic matter in the cores are denoted by x's (xxxxxxx).

4. Sample splits from all the cores are archived with the U.S. Geological Survey in Menlo Park, California.

5. Radiocarbon ages were determined at the U.S.G.S. radiocarbon Laboratory in Menlo Park.

6. Photographic prints of the cores are available at cost through the U.S.G.S. Photographic Library at Menlo Park, California. Inquiries may be sent to: U.S.G.S. Photographic Library, 345 Middlefield Road, Menlo Park, CA 94025.

Dill, R.F., and Moore, D.G., 1965, A diver-held vane-shear apparatus;

Marine Geology, v. 3, p. 323-327

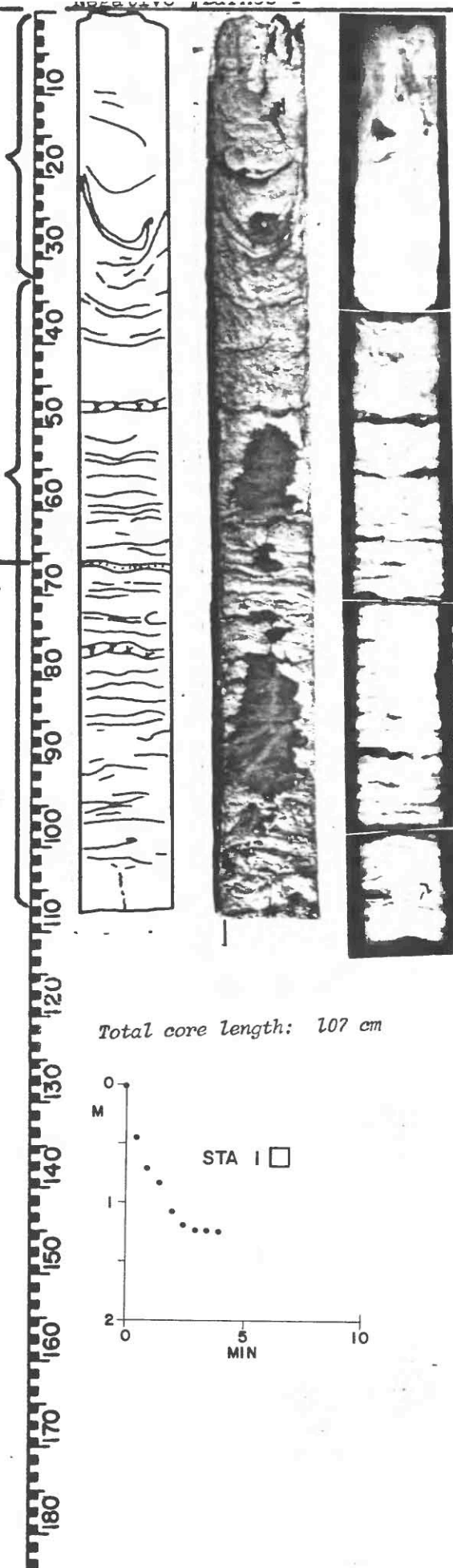
Medium grey silty clay to clayey silt banded as drawn, with bands marked by organic (very fine) mud. Several small pebbles to granules. Small fragile shell fragments of 23 cm.

Probably disturbed during sampling.

Horizontally banded to mottled silty clay/clayey silt. Banding marked partly by fine organic concentrations, giving dark color, or variations in silt/clay ratio. No pebbles or shells. Does not become noticeably stiffer near bottom.

The station log may say that winch cable was jammed, preventing further penetration.

irregular
medium
sand layer



Core v-1 Depth: 3 m 70°19.0 N, 148°22.0 W Remarks: Central part, mid-Prudhoe Bay

Core

Irregular layers or pockets of clean oxidized fine sand. Sandy mud interbedded with sand layers in upper part, mottled below 10 cm depth.

Poorly defined contact

Homogeneous to mottled, slightly muddy medium to fine sand, grey, with pebbles from 25-40 cm, becoming grey, clean, homogeneous medium sand at 50 cm; 50-70 cm no pebbles or shells.

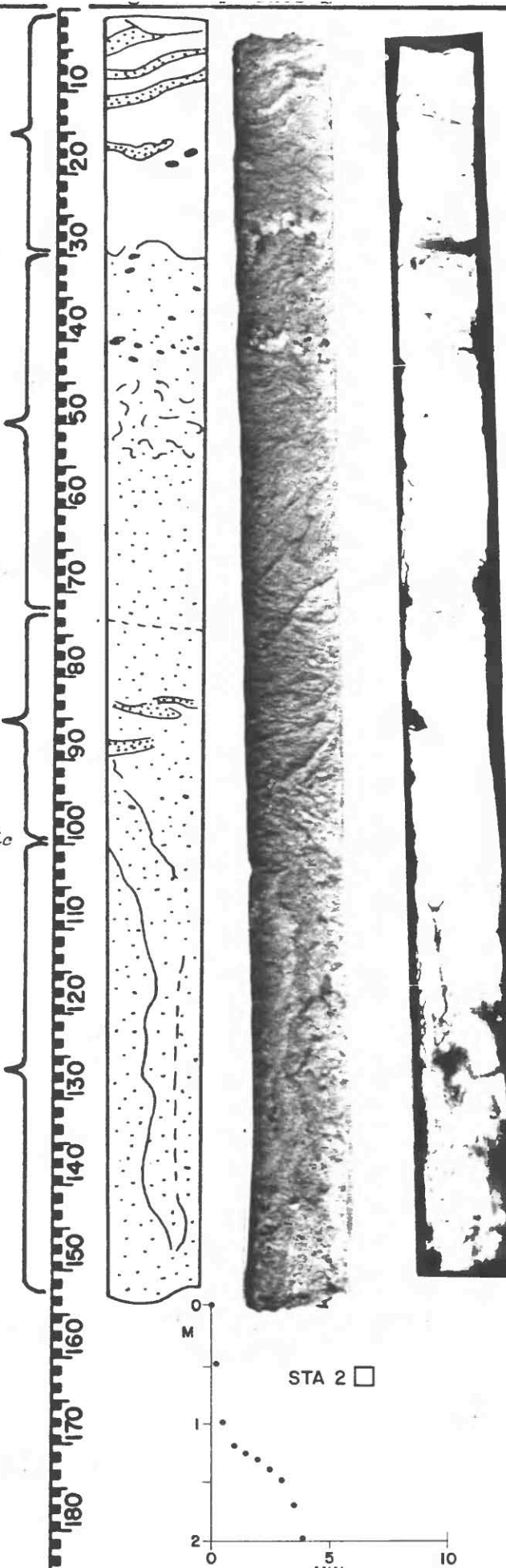
Oxidation boundary

Dark brown-grey, medium to fine sand especially dark at 80 cm; very fine humic substance when washed. Irregular horizontal banding 75-85 cm disrupted below 85 cm. A few pebbles as sketched.

No real boundary; marked by granulometric differences.

Disturbed core, medium sand, clean, grey, slightly oxidized along right side. Slight admixture of mud and very fine organic substance along left side making this half dark brownish grey.

Homogeneous clean, grey, medium sand below 145 cm. Several pebbles as sketched.



Medium to fine, partly oxidized sand, upper 10 cm homogeneous, ripple bedding in lower part, marked by concentrates of organic fines, and coal.

Fine, grey sand, smooth horizontal laminations marked by coal-rich laminae

Grey, silty clay, wavy to mottled upper surface with small sand lenses

Grey, fine sand, becoming medium sand at 4 cm and gravelly sand (partly oxidized)

silty clay lens and pebble

lens of fine, organic material at 47 cm,

sharp, irregular contact

thin, irregular sand layer

dark grey, mottled to horizontally-banded clayey silt organic-rich laminae

Medium sand and gravel, partly oxidized, with coarse shell at top.

sharp contact

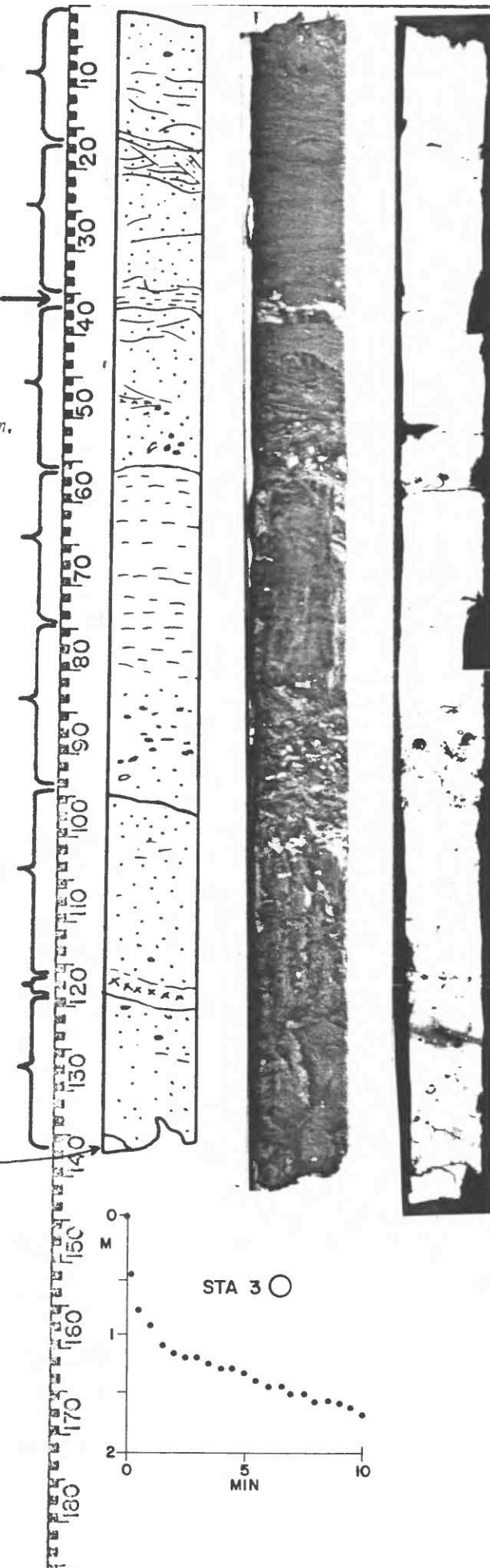
Dark grey muddy medium sand, banded horizontally in upper 10 cm, becoming structureless, with numerous small pebbles at 105 cm.

black, organic-rich fine sand with several small pebbles

Partly oxidized medium clean sand, with few pebbles down to 126 cm. Structureless, except for elongate horizontal pocket rich in mud at 126 cm (including one pebble) on right side.

pocket of brownish muddy sand

137 cm total core length



Core V-3 Depth 1.5 m 70°24.0'N, 148°33.2'W Remarks: East end of Stump Island

Grey, slightly muddy medium to fine sand, homogeneous to mottled.

more muddy in pockets on both sides, and burrow? in center

Sandy mud, bioturbated, with very irregular upper contact horizontal banding marked by organic-rich dark layers

clean, fine sand-grey organic lenses with thin clay-rich layer between

mottled sandy mud, organic, black lens at 39 cm

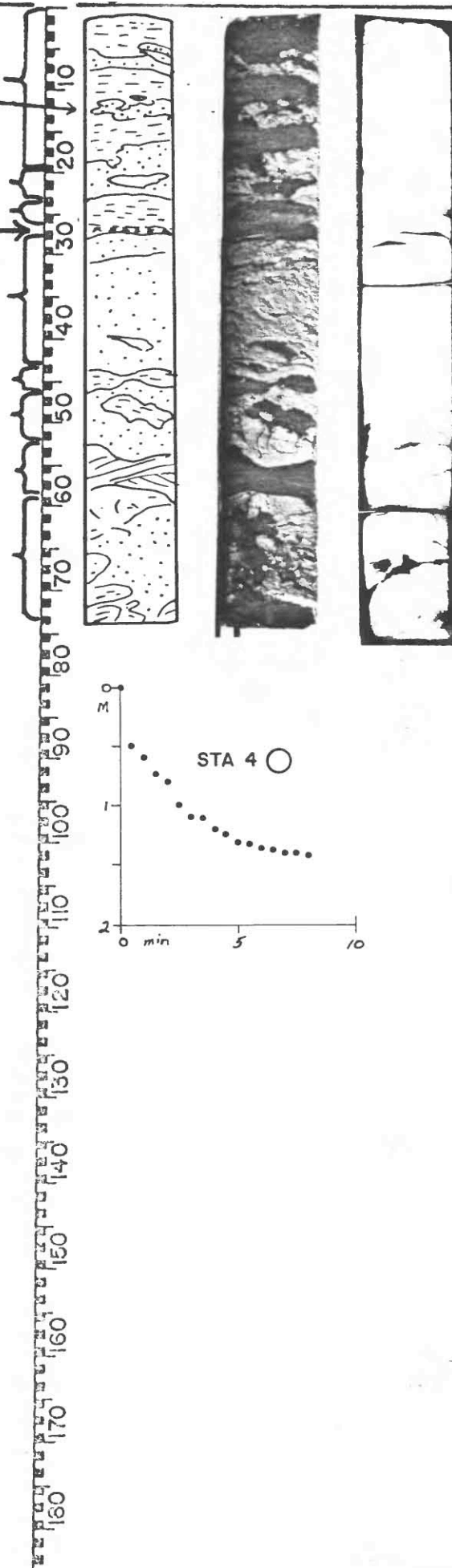
Muddy, mottled grey fine sand with highly mottled and muddy organic-rich sand in central part of unit

firm, hard to cut, banded silty clay with highly irregular upper contact ripple-bedded, muddy fine sand

Firm, muddy fine sand, broken up during cutting due to core catcher. Mottled in upper part, possibly horizontally bedded near base. Several small shell fragments near base.

Lower 25 cm of core was resistant to wire cutting

Organic-rich layers consisting of very fine size.



Light grey sand, fine and clean down to around 30 cm, gradually becoming medium sand, clean for rest of core. Now oxidized. At 60 cm to bottom, color slightly darker grey, but barely noticeable. No minor structures noticeable except at 100 cm apparent bedding planes as sketched. No shell material.

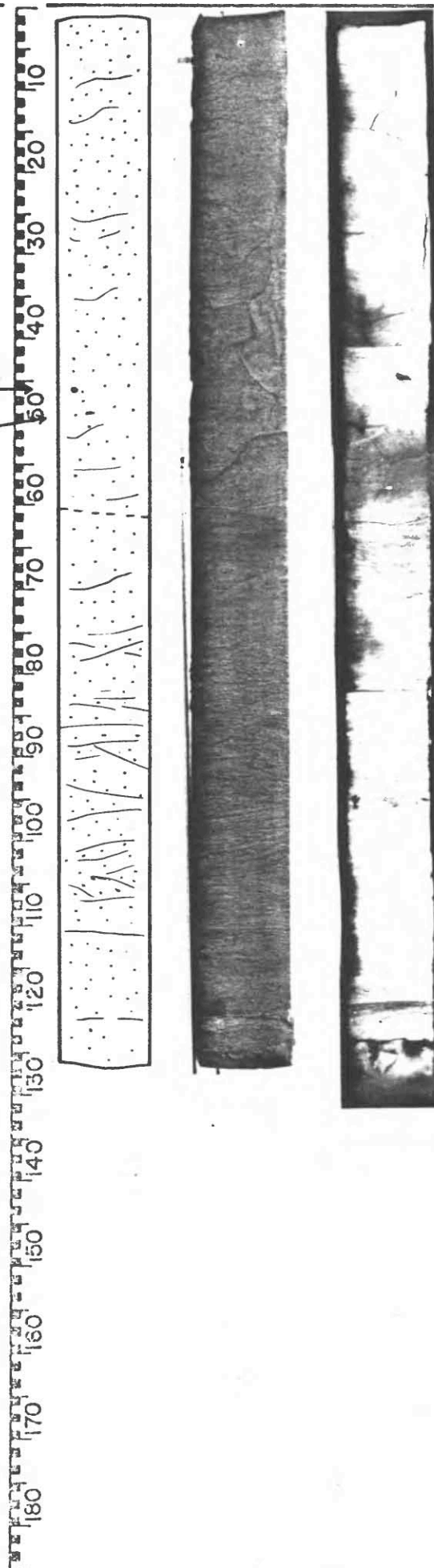
Core rather dry in upper 30 cm but still damp below.

pebble

granule

Subsequent observation on core since peel was made (this photo) revealed primary sedimentary structures. The upper 60 cm consists of plane bed laminations. Coring has disturbed the edges. Rippled cross beds and parallel laminations are between 76 and 113 cm.

Total core length: 126 cm



Light grey, fine, clean, homogeneous sand, beginning at 40 cm to grade into medium sand. Occasional granules to small pebbles. No shells.

Sand unit has a few pebbles throughout.

sharp, smooth contact

Slightly sandy fine gravel with high amount of granule-size material, rounded as beach material, few small shell fragments. Some fining toward base.

sharp smooth contact

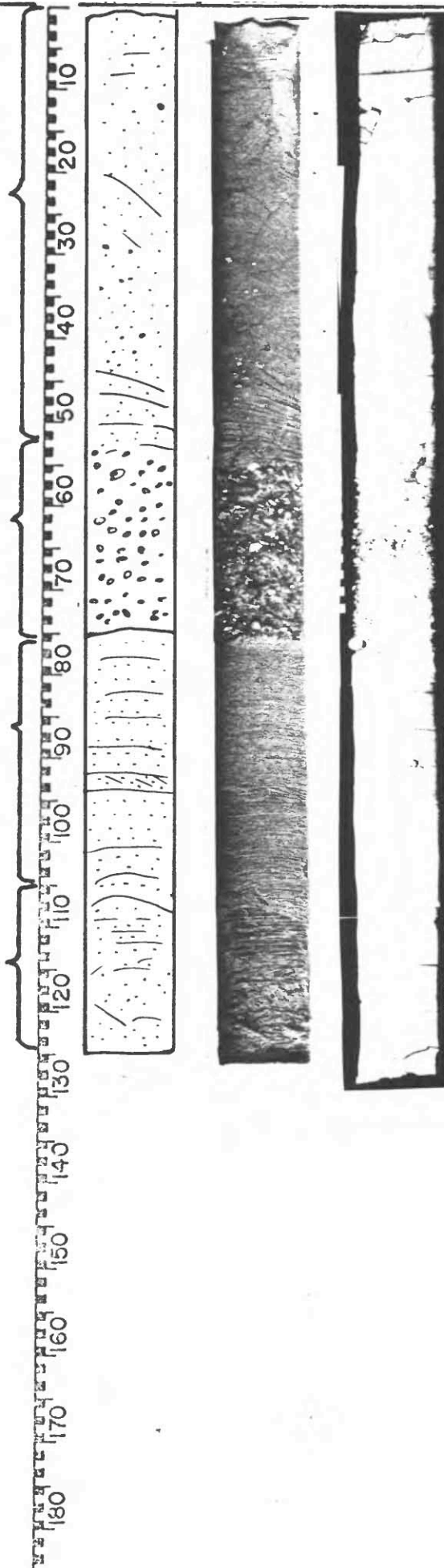
Fine to medium clean sand, trace of horizontal bedding. No pebbles or shells.

Fine sand, thinly bedded, possibly with very fine mud whiskers intercalated. Unit is medium grey, definitely darker than above.

mud
lump

mud
lamina

Total core length: 124 cm,
No core catcher.



dark grey silty clay lumps

light grey color band
slightly oxidized above
and below the 1 cm band

mud lumps, large one dark grey silty clay

Clean, grey, medium grained sand
with only traces of bedding. Un-
conformity at 45 cm seen in peel
with distinct bedding from
45-65 cm.

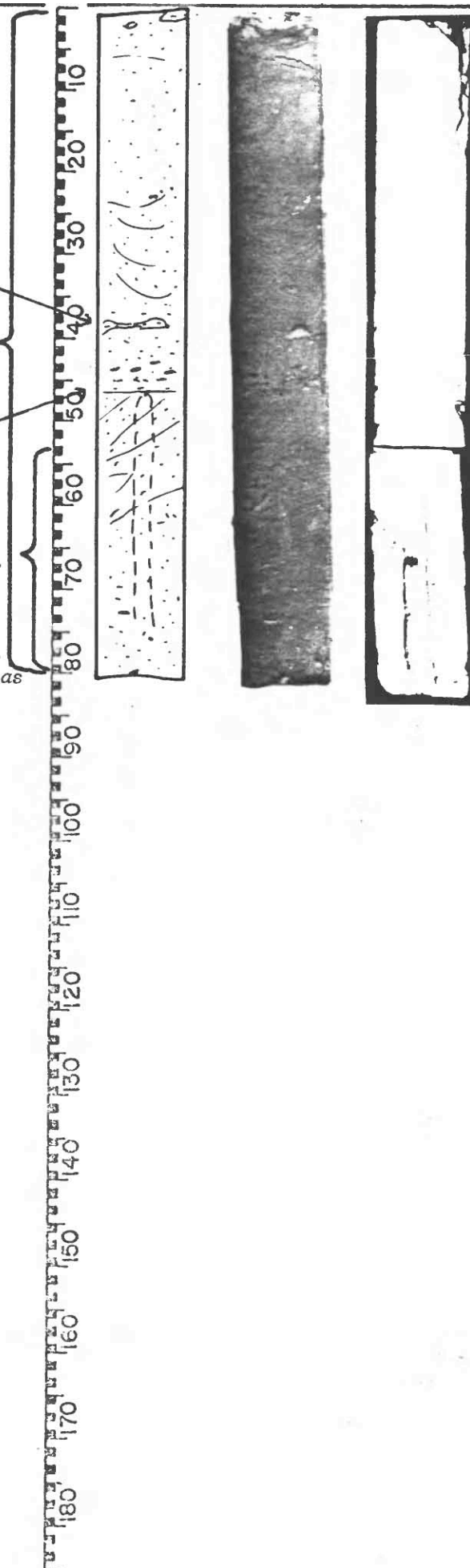
winnow surface with mud lumps and shell fragments and
slightly coarser sand near base

Large vertical burrow, sand slightly oxidized

sketched features represent small, flattened, silty clay
lumps that never occur as continuous laminae

NOTE: small (minute) shell
debris throughout core, but
concentrated in two layers as
sketched, No pebbles

Total core length: 70 cm (no core catcher)



Core V-7 Depth 11 m 70°30.5'N, 148°21.6'W Remarks: North of Reindeer Island

Medium to coarse sand with few scattered granules and small shell fragments, structureless, gradually fining down to fine-medium sand

Fragment of stiff, silty clay, medium grey, mixed with surrounding sand by ice pressure. Has sharply defined margins, but highly irregular.

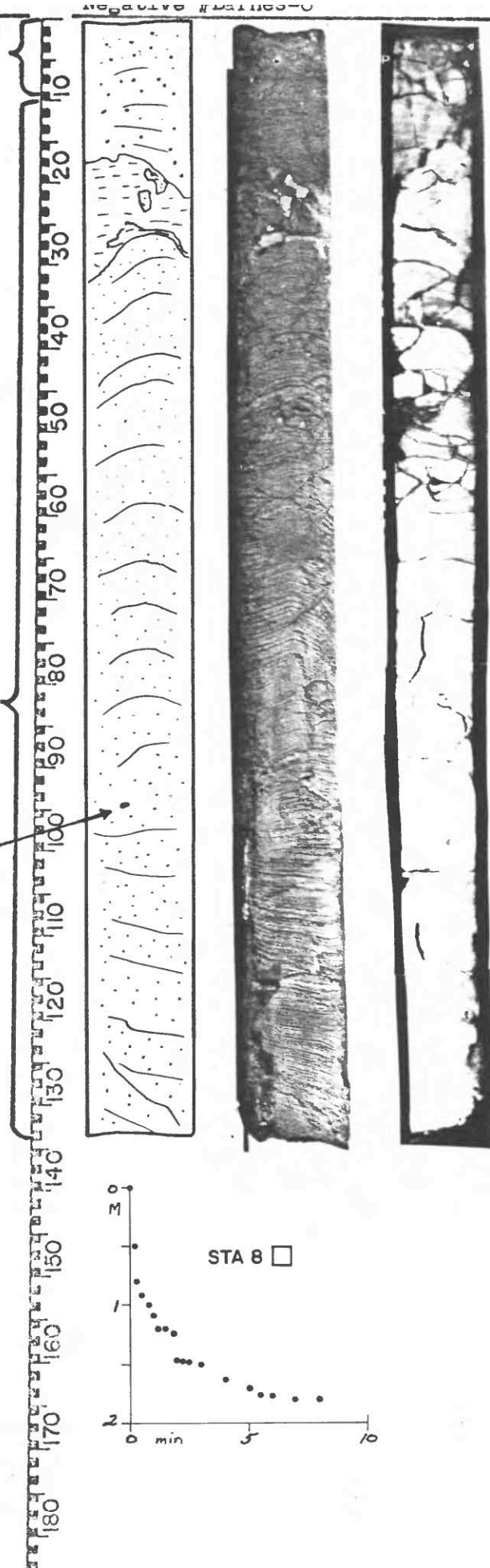
2-3 mm smooth layers of medium sand

Fine to medium, clean sand, subrounded unoxidized. Horizontal bedding planes as sketched, being most pronounced from 102 cm down to 115 cm. This bedding is not from noticeable variations in grain size or sorting, but light grey to medium grey color variations, and from peel.

small clam valve

at 114 cm and 115 cm core- 1-2 mm laminae rich in dark string particles (coal?) These laminae are oxidized.

NOTE: very few faces of fine shell debris in the core. No pebbles.



Core V-8 Depth 8 m 70°29.8'N, 148°20.8'W Remarks: North of Reindeer Island

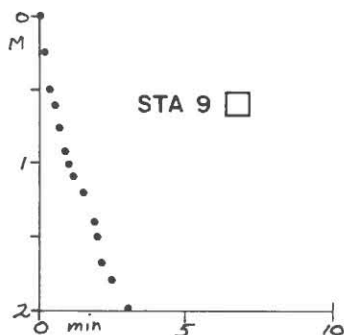
Two shells at surface, one live *Astarte*

Dark grey, medium sand, angular, structureless, with a few granules and a small pebble. Possibly some shell fragments. Becoming more muddy, with mud in little pockets.

Irregular contact, ill-defined clay layer

Dark grey, sandy silt, irregular, horizontal banding
angular pebble clay-rich
shell fragments

dark, organic rich, but fine grained layers
Horizontally banded clayey silt, banding mainly alternating dark grey/olive drab color in some areas mottled without bands. No shells, no pebbles.



clay layer

clean, light grey, fine sand layer

Dark grey, muddy fine sand, band: horizontal sometimes deformed by larger mud content gradually becoming less sandy--more muddy downward. Little to no structure from 130-140 cm. Shell fragment at 137 cm.

thin, fine organic layer

Dark grey, sandy, clayey silt, well bedded, bedding mostly defined by fine organic rich layers (crosses)

clean, light grey, fine sand

core catcher

Total core length: 169 cm; core catcher activated: some downslipping. Few angular pebbles as marked. Core not becoming much firmer toward bottom.

Core V-9 Depth 6.5 m 70°20.1'N, 147°31.1'W Remarks: Stefansson Sound south of Narwhal Island

Central cut - no shells observed
 Generally dark, reduced sandy mud with
 small olive oxidized zones at surface
 and below 32 cm.

10 cm gravel concentration

0-25 cm parting planes || to sea floor

25 cm gravel concentration

(the finest material in core)

at 30 cm, wavy, medium grained sand
 unit

Between sand unit and flame structure
 mottled appearance

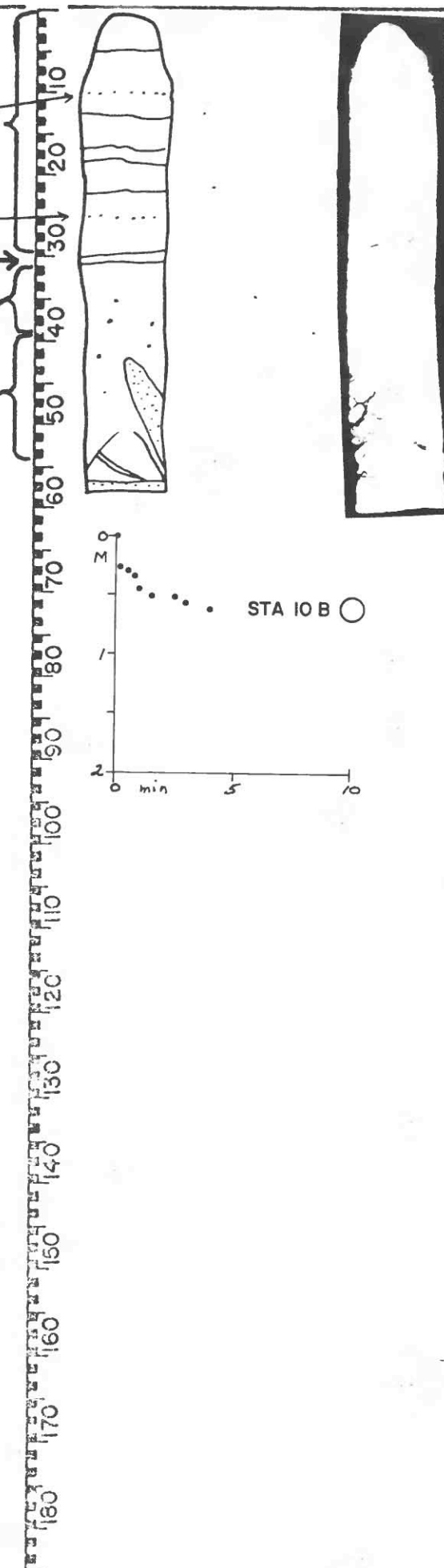
40-53 cm

Medium-coarse grained sand structure -
 related to coring technique

Additional medium to coarse grained
 sand in core catcher. Coarser than
 muddy sand above.

(1) small sliver of wood

Matrix? Breaks in conchoidal fracture
 pattern in very stiff-mottled silty
 material.



Core V-10B Depth 27 m 70°17.1'N, 147°44.3'W Remarks: Off Pt. Brower east of Sagavanirktok River

brownish grey sandy mud
sand and pea gravel mixture, oxidized,
one shell.

light grey silty clay layer
slightly pebbly medium sand

Coarse, sandy gravel clasts up to
3 cm diameter (sand sub-angular)
(pebbles rounded, similar to beach).
Several small but thick shell frag-
ments. No structures.

Slightly sandy gravel - gravel clasts small
smaller than above unit. No structures.

slightly pebbly sand
Rather well sorted pea gravel (granules
largely) rounded, small, coarse sand
content.

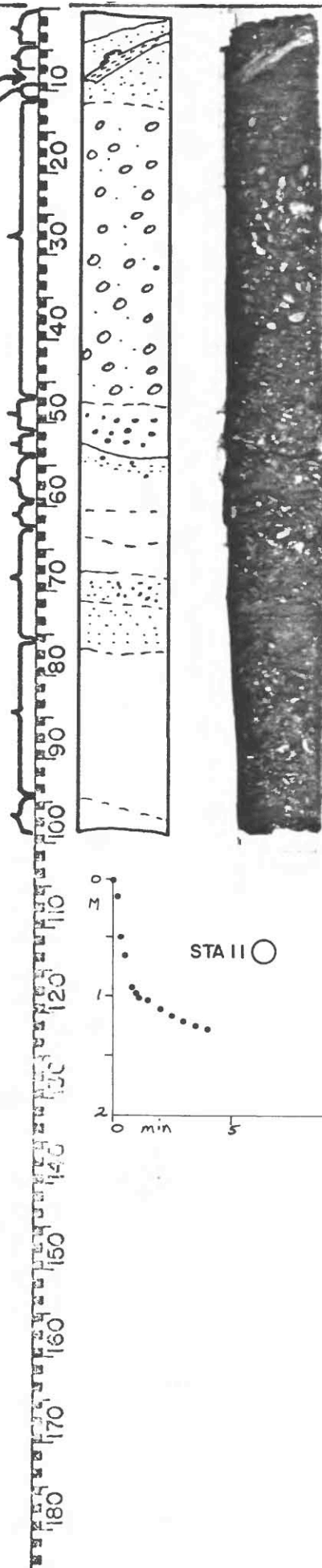
sandy gravel

Slightly pebbly, medium to coarse sand -
no structures.

Sandy gravel, similar to beach material
in roundness, small shell fragments.

Medium sand with few pebbles, probably
disturbed, as it came out of core cap,
which was only partly on the barrel.
Portion of core probably lost during
capping.

27 cm of core



Core V-11 Depth 1 m 70°17.7'N, 147°47.0'W Remarks: Off Pt. Brower

Medium, sand, partly oxidized in upper 15 cm, shells at 8 cm. below mud-ball layer grey fine sand trace of smooth, horizontal lamination?

Interlaminated clayey silt & fine sand.

Black, organic rich layers and lens

Silty fine sand grading downward into

Mottled silty sand interspersed with mud.

Bedded clayey silt, at base muddy fine sand with ripple bedding.

Fine sand, clean, grey, homogenous?

Clay rich layer, irregular

Medium grey, clayey sandy, silt to silty sand highly mottled - disrupted. Some show mud balls and irregular sand pockets.

Silty clay with highly irregular micro relief on surface and bottom.

Layered to laminated clayey silt and fine sand, ripple bedding?

Fine silty sand

Dark fine organics

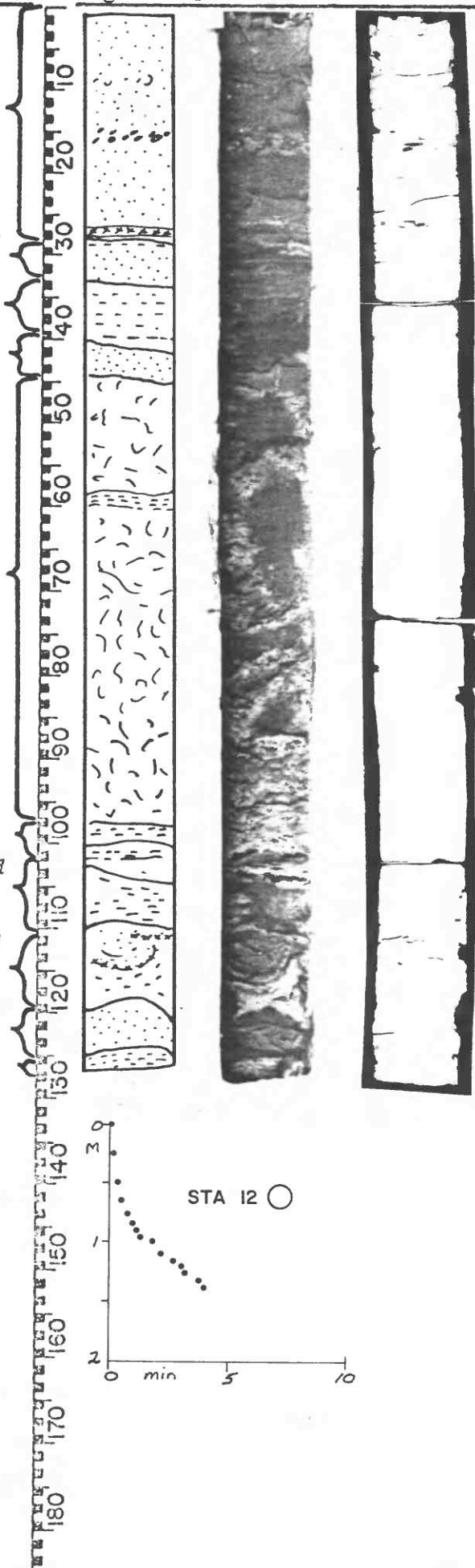
Irregular, silty clay, light-grey, muddy fine sand near base.

Dark grey, homogenous fine sand

Horizontally bedded silty clay

Total core length 126 cm.

Note: Lower half of core rather firm. No pebbles, apparently no fibrous organic layers. Coarse enough for dating purposes.



Core V-12 Depth 3 m 70°24.1'N, 148°18.5'W Remarks: North of Prudhoe Bay

Interspersed pockets of sandy mud (grey) and oxidized fine to med. sand

Oxidized, clean, fine to med. sand, with 2 lenses of grey mud, grading down into sandy mud

Sandy mud.
Astarte valves.

At 30 cm very mottled on left side
very soft silty clay, light grey, homogenous, with lenses and irregular pockets of grey, fine sand as sketched.

Fine-med. silty sand, upper and lower boundary rather sharp but with minor burrows?

Grey clayey silt

Clayey, sandy silt. Horizontal dark-light boundary in upper part, mottled with irregular sand pocket or admixtures in lower part.

Muddy sand pocket
Irregular sand layer with shells

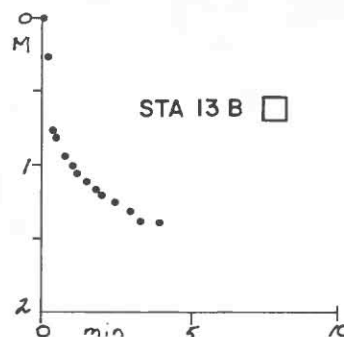
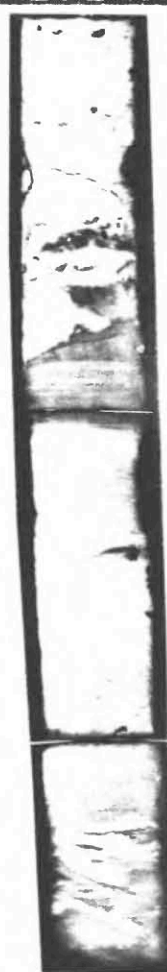
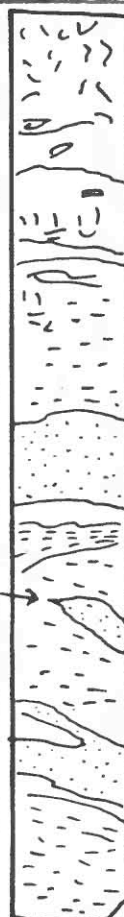
Dark grey/light grey color banding, horizontal, in clayey silt, rather firm.

Total core length 88 cm.

Note: flap was pushed down and across core, lower 10 cm disturbed and ~ 10 cm downward slippage occurred.

Since the lower part of core stopped and we don't know why we were unable to penetrate deeper than 98 cm.

Bivalve



Upper part disturbed with void, empty, possibly representing burrow.

Soft, brownish grey homogenous silty clay, sandy in upper 5 cm. Several small, irregular sand pockets from 5-10 cm down in core.

Granule/pebble sand with some very small shell fragments.

Silty sand lens.

Sandy Silt Pockets

Brownish grey silty clay. Structureless mainly, with trace of color banding to 22 cm depth, and below 40 cm again. 22-40 cm disrupted. Core catcher as drawn, causing disturbance from 50-60 cm depth.

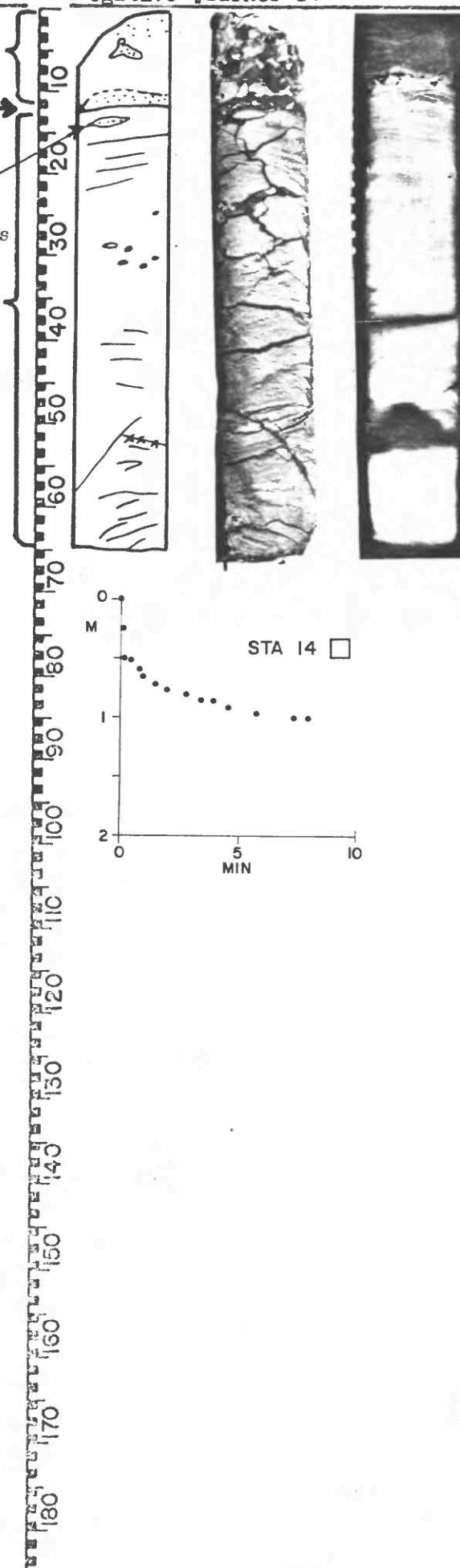
Dark, fine, organic rich, possibly including coal.

Color banding.

Total core length 66 cm, but a few cm of downward slippage of core must have occurred, resulting in loss of some sediments.

Sediments becoming gradually finer from top to bottom. But what stopped further penetration?

No shells collected, or seen in first cut. Except for sand, layer at 12 cm no pebbles.



Core V-14 Depth 1.5 m 70°41.5'N, 150°27.2'W Remarks: North of Colville Delta

Grey, muddy, medium grained sand, grading at ~ 2 cm into oxidized clean, medium grained sand. Apparently homogenous. Highly irregular contact with clayey silt with numerous irregular pockets of fine silty sand.

Grey, homogenous, clean, medium sand, irregular sharp upper contact. Smooth, sharp lower contact.

grey, homogenous silty clay, with small, minute sand pockets.

Irregular, thin muddy sand layer.

Grey, clayey silt, small sandy pockets, one 5 mm pebble on surface, shells

irregular layer of fine sand and shells

Grey clayey silt, with irregular pockets and lenses of fine sand irregular horizontal layering in lower half.

Medium to fine grey clean sand, sharp-smooth lower, wavy rippled sharp upper contact.

Homogenous silt, grading down into clean, grey, fine sand, sharp, irregular lower contact.

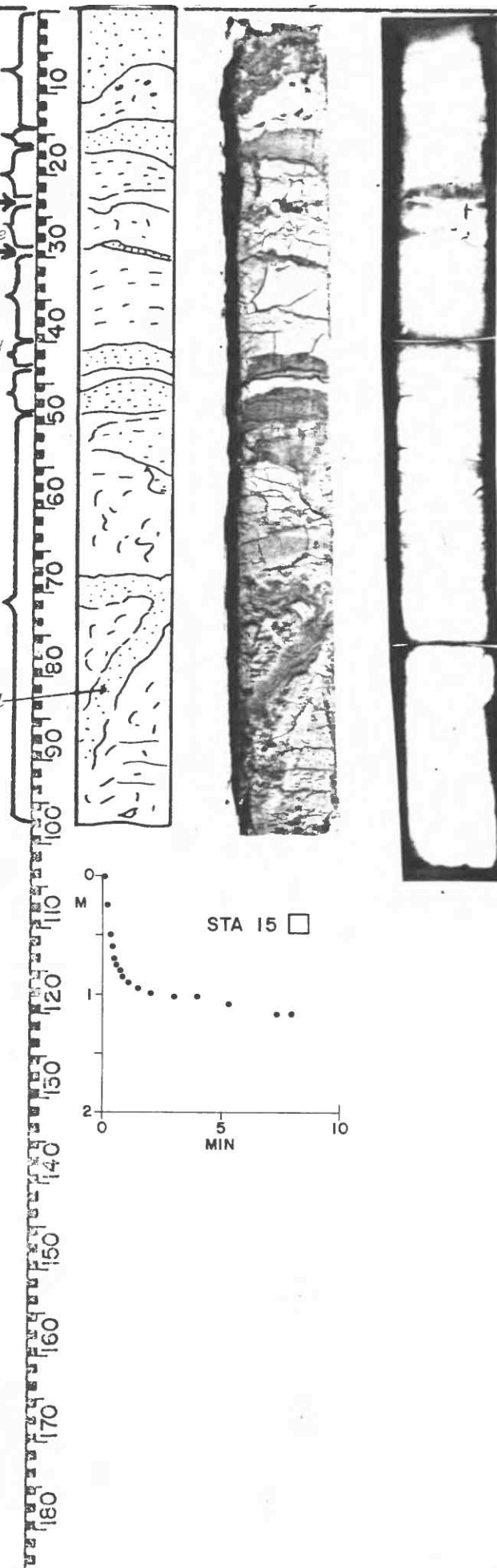
Churned-up grey clayey silt, with intermixed irregular sandy pockets, become darker grey from ~ 70 cm on down (gradually).

Irregular unit of clean, fine, light grey, several small fragile shell fragments.

98 cm total length.

Notes: Ice disrupted below 45 cm, probably also from 8-14 cm.

No organic-rich layers. Two pebbles in first cut face. Numerous small, fragile clam fragments, preferentially in muddy sediments. Grade size of sand units does not change through length of core.



Core V-15 Depth 12.4 m 70°37.0'N, 150°27.0'W Remarks: North of Colville Delta

Trace of horizontal bedding, characterized by dark and light banding, and discontinuous silty laminae and pockets. No organic rich layers.

Sandy silt

Irregularly molted, probably ice-disrupted, grey silty clay.

Small silt pockets - Abundant forams - espec. 25-30 cm
Silty sand pocket

Numerous broken and complete shell fragments.

Grey, silty fine sand, may have some small fragile shell fragments. With trace of dark banding, horizontal as sketched.

Interlaminated clay-rich/ silty sand, horizontal

Intensely molted grey silty clay (Light-to-dark-grey alterations).

irregular muddy sand pockets.

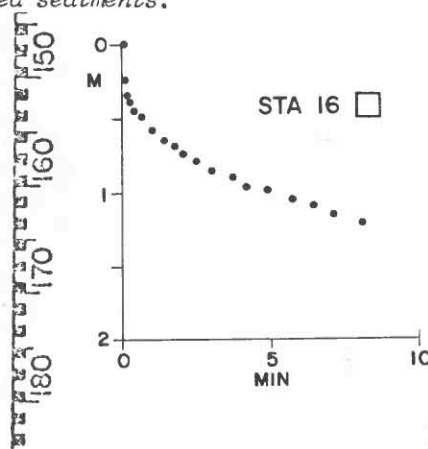
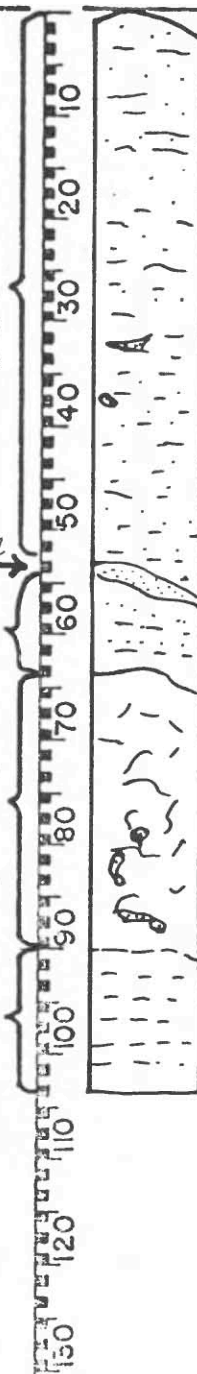
Light grey to dark grey silty clay/clayey silt, laminated, but irregular.

103 cm total penetration.

Core was cut with comparative ease, had no pebbles, no pronounced fibrous organic layers, and only a few small fragile clam fragments near and in sand unit (within first cut face).

Becoming stiffer toward bottom, gradually.

First interpretation calls for ice disrupted sediments.



Core V-16 Depth 11.5 m 70°36.3'N, 150°28.2'W Remarks: North of Colville delta

Very soft and wet in upper 5 cm

Homogenous appearing blob of silty clay, grey, sitting suspended in grey, homogenous clayey silt. Probably sampling disturbance. Contact with underlying clay very irregular.

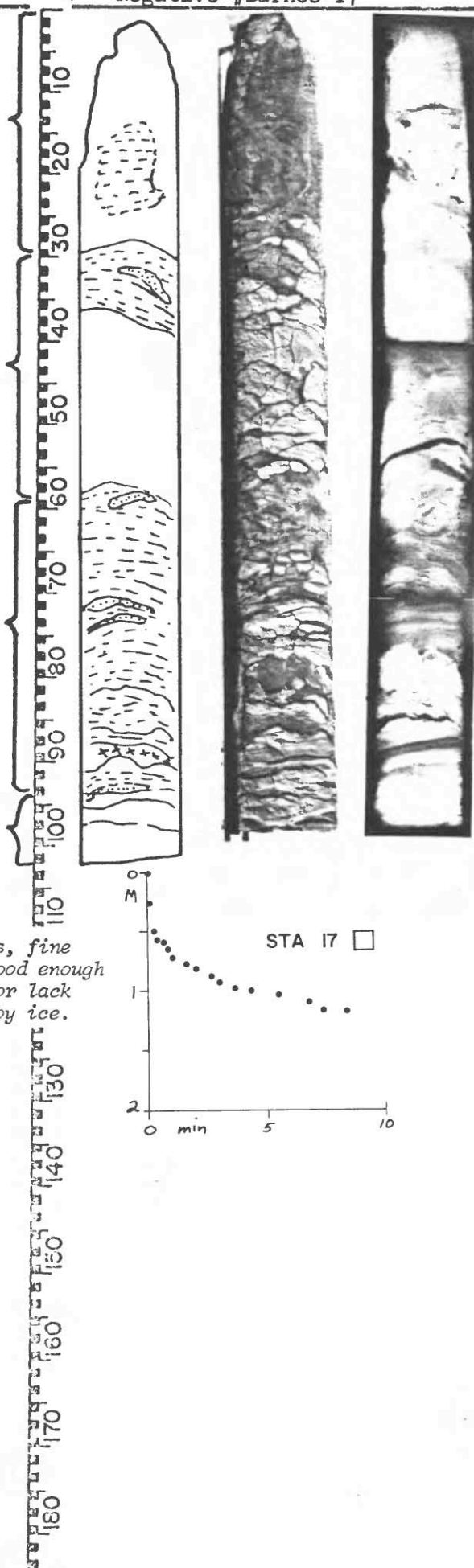
Light grey, cohesive silty clay, mottled by burrows or disrupted by ice, trace of prior horizontal banding? Remaining.

Sand pockets.

Light grey silty clay with convex upward bedding some marked by thin, fine sand layers, but fine sand generally occurring in irregular small pockets, or (near 80 cm depth) thicker layers marked by flame structures of silty clay. Scattered small shell fragments, mainly around 60 cm depth.

Clay silt, molted slightly firmer than sediments above, with irregular small sand pockets.

Note: Not a single pebble, only small clear fragments, fine grained organic matter (dark band) at 95-96 cm, not good enough for dating. Core was cut easily, no obvious reason for lack of deeper penetration. Upper 50 cm appear disrupted by ice.



Core V-17 Depth 8.5 m 70°34.0'N, 150°28.2'W Remarks: North of Colville delta

Grey silty clay with interbedded lenses of oxidized medium to fine grained sand. Clay contains lenses of organic matter. Bedding plane lamination and fineing upwards in sands.

Grey clayey silt, interlaminated with fine org. and coal
Silty clay, grey.

Dark grey, muddy fine sand rich in organic matter
very coarse fibrous in lower part

Homogenous silty clay, grey

C^{14} subsample
2270 + 55 y

Fine sand with some organic matter
Laminated sandy silt

Fibrous organic matter

Grey, soft, silty clay, in upper part several laminae of organic matter, shown dark in photos.

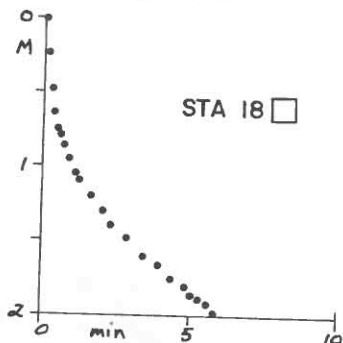
97-98 cm for C^{14} 3040 + 50 y

Clean washed, coarse fibrous organic matter

Grey silty clay, soft, possibly horizontal banding in upper part.

In lower part, large wave structure marked by more clayey layers and lamina rich in organics.

Ice disturbance



Light grey, soft, homogenous slightly silty clay

Note: Except for peat layers, entire core was easily cut with wire. No shells or pebbles.

Core V-18 Depth 3.3 m 70°33.2'N, 150°27.9'W Remarks: North of Colville delta

Paraffin plug the "burrow" may be from boathook, used pushing the cap into box; but sand is dense, and should not be penetrable. Also burrow is irregular, with smaller burrows adjacent.

Medium grained, oxidized, clean sand grading downward into fine sand with some silt. The sub-horizontal lines drawn in represent coal laminae.

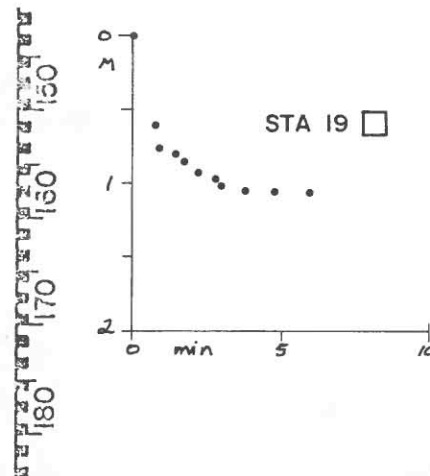
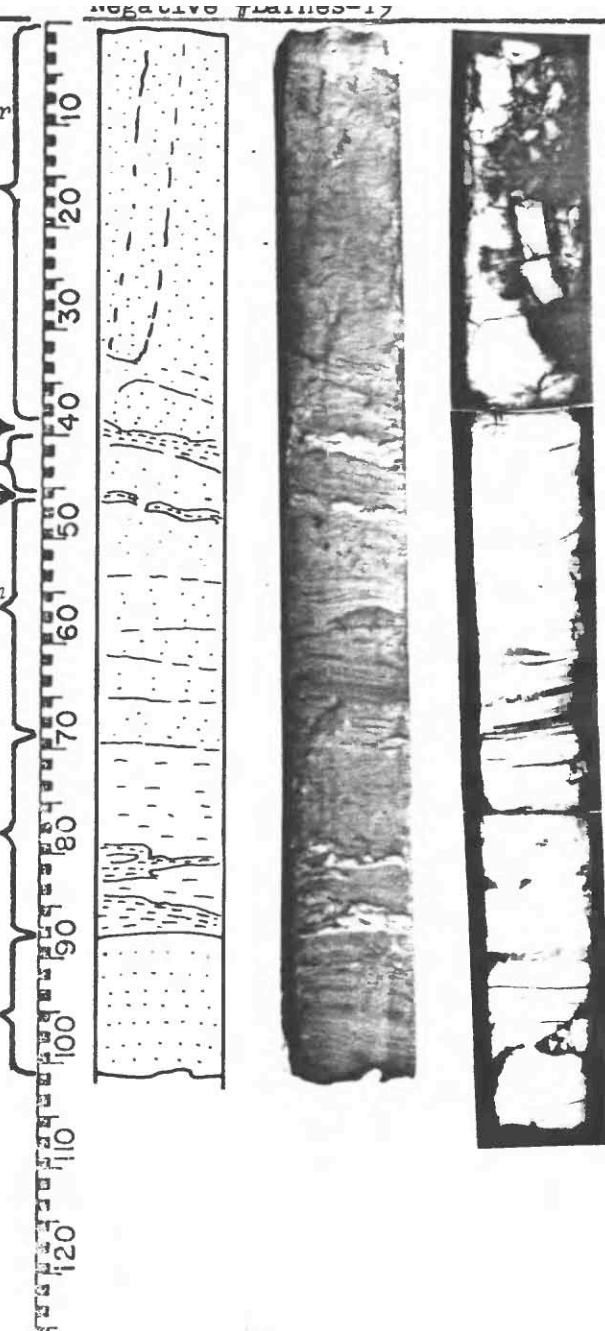
Clay layer with small sand pockets
Clean fine sand, grey
Sandy, clayey silt with horizontal bedding.
One black, rounded pebble in x-ray slab

Fine gray sand interbedded with organic and coal rich laminae and lenses. Ripple bedding in central part

Sandy, clayey silt, somewhat mottled with trace of horizontal layering indicated

Horizontally layered fine, grey, sand; dark layers are coal concentrates apparently no ripple bedding.

The core was easy to cut with wire, and comparing nature of sediment with long cores through stiff silty clay, I believe we may have hit ice-bonded sediment at 103 cm. Also, note rate of penetration curve. On first cut face no shells, but in sub-sampling a few were picked and put in vials.



Dark brown, possibly burrows
Clean, fine sand, light brown-oxidized
Laminated in lower half, mottled upper half

Fine sand, dark brown, rich in coal and probably
organic material, but not fibrous.

Light grey, muddy fine sand, interbedded with thin
laminæ of fine-fibrous, dark organic matter also,
lenses. Undisturbed in section from 15-28 cm, from
28-48 cm, concave upward structures possibly due to
sampling procedure. Relatively undisturbed layering
around 50 cm. 55-62 cm concave upward bedding planes

Concentrated fibrous organic matter
 C^{14} Sub Sp.

Homogenous clean sand

Muddy, org. rich layers (dipping $\sim 30^\circ$)

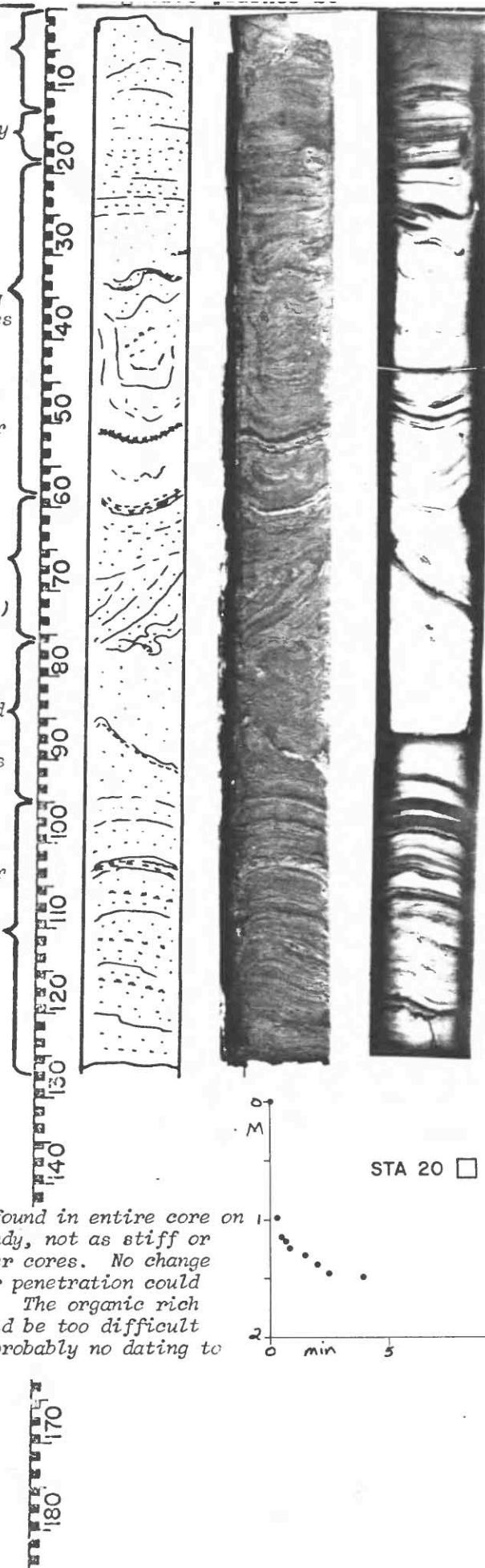
Light grey, muddy fine sand, mottled or bioturbated

Most pronounced organic layers

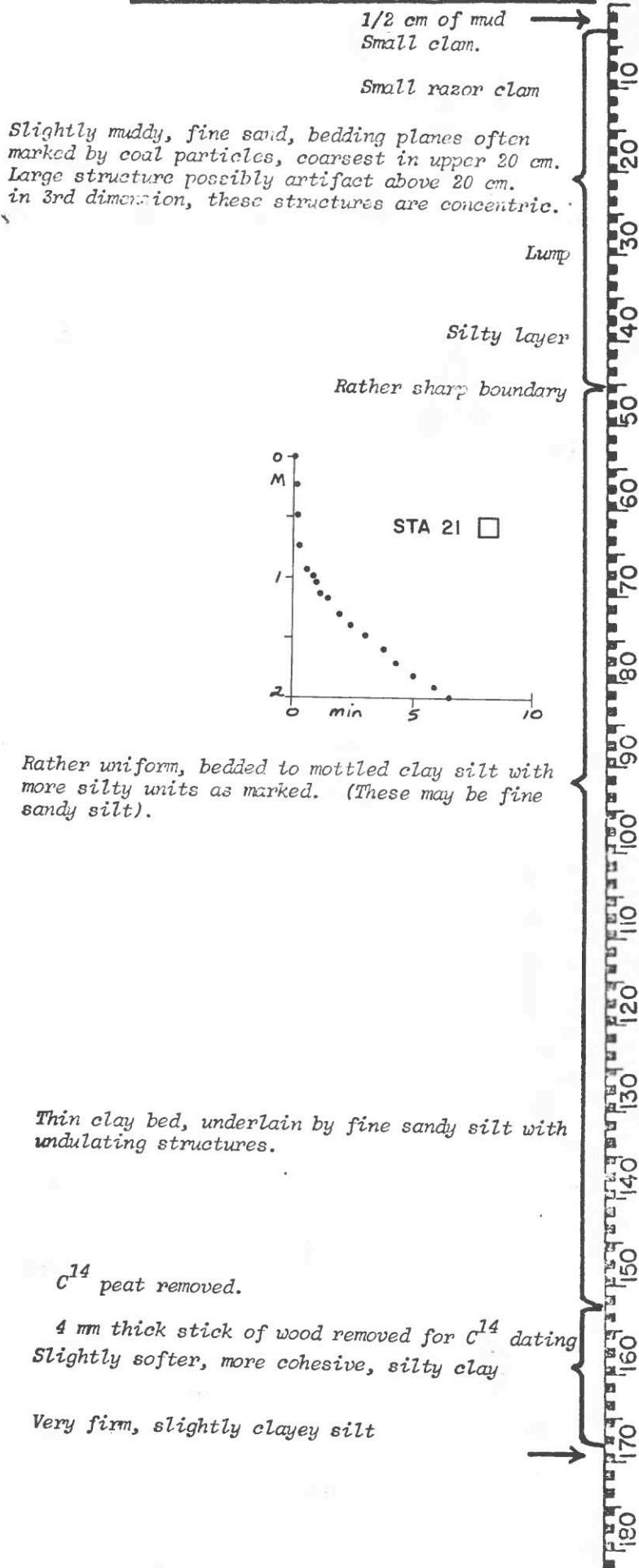
Clay layer

Light grey, muddy, fine sand interlaminated to
interlayered with dark layers rich in very fine
grained, soft organic matter, mottled from
108-114 cm.

Note: Not a single pebble, one shell found in entire core on
first cut face. Entire core rather sandy, not as stiff or
resistant to penetration as other longer cores. No change
in very bottom of core. Lack of deeper penetration could
possibly be due to ice-bonded sediment. The organic rich
layers are so fine grained that it would be too difficult
to separate coal prior to C^{14} dating, probably no dating to
be done.



Core V-20 Depth 1.5 m 70°31.4'N, 150°27.5'W Remarks: North of Colville delta



Note: Not a single pebble in core. No fibrous

Core V-21 Depth 4 m 70°33.8'N, 151°01.0'W Remarks: N.W. of Colville delta

Upper 30 cm dried out, friable, and cracked during slicing for x-rays

dark lamination
marked by coal

Very fine sand/silt layers

Fine, brownish, well-sorted sand with slightly undulating, generally horizontal layering. Bedding planes marked either by traces of coal (shiny fracture surfaces on sand size black particles) or very fine sand with traces of mud.

Major, unexplained structure as shown on central portion possibly leading along left margin of core to very surface of core.

Coal particles and very fine fibrous org. matter

Trace of coal concentration along bedding planes

Several small clam fragments

1/2 cm silty clay layer

Clam fragments and entire valves

Clayey silt interbedded with sand lenses and laminae

Sand layer, slight trace of horizontal bedding

Sandy clayey silt layers

Clayey silt layers interbedded within sand lenses and layers, mottled, probably from bioturbation.

Coal particles

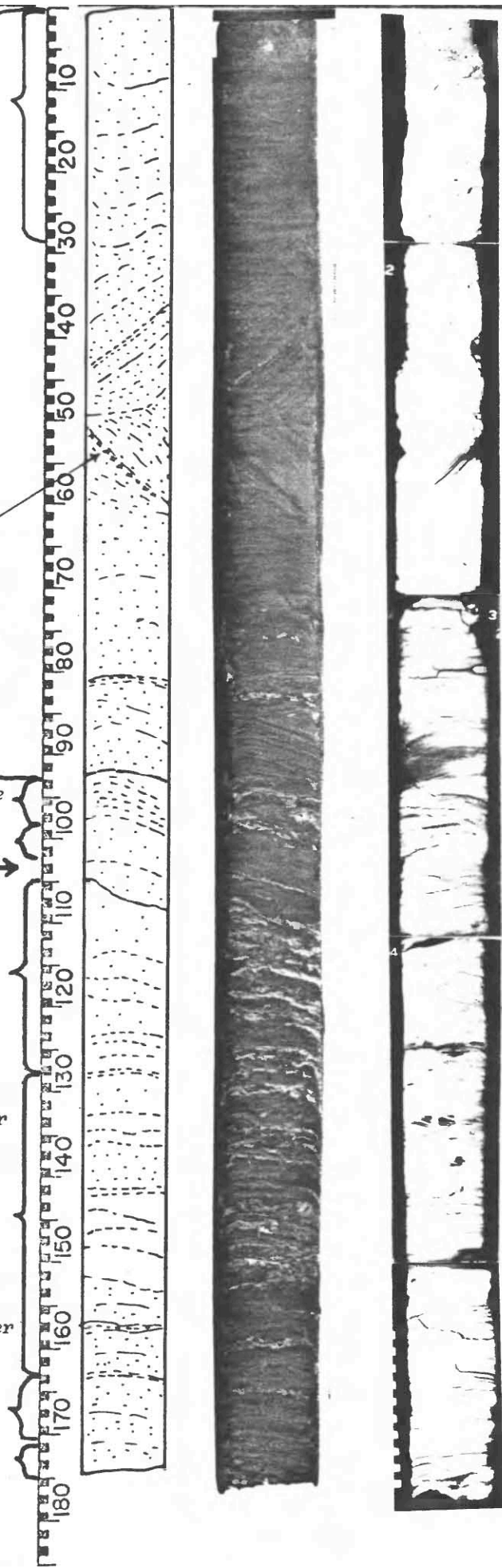
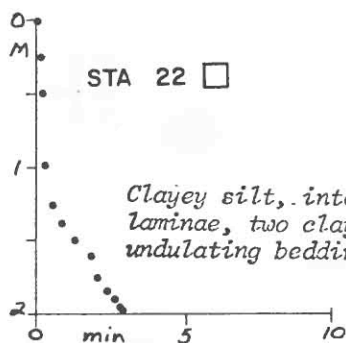
Coal particles in regular
lenses and layers.

Clayey silt, interbedded with sand lenses and laminae, two clay layers, flat horizontal to undulating bedding, no bioturbation.

Clay layer

Sand with horizontal coal laminae

Cohesive silt rich in coal and organic material



Core V-22 Depth 0.6 m 70°32.5'N, 150°59.6'W Remarks: N.W. of Colville delta

Apparently lost ~ 1 cm fine/med. grain oxidized sand

homogenous, brownish silt, possibly some bedding

9-10 cm, clean, oxidized, fine sand containing thin clay lamina.

Clayey silt with 1-2 m sand laminae interbedded, no ripple structures at 26 cm a 3 mm lamina of fine organic bedding slightly undulating. No pebbles, no sticks, no shells, no bioturbation.

35-47 cm fine-medium grained sand, mottled, perhaps bioturbated, brownish to gray alternating patch.

Silty, laminated, thin organic whiskers, 2 layers with fibrous org. material, thin sandy lamina between them, clay (1.5 cm) on bottom.

C-14 23-1 sub spl.

Clayey silt interbedded with thin sandy laminae. Fibrous org. material in lower 2 cm. No critters, no burrows, no pebbles.

Fine, gray sand with interbedded lenses of fibrous organic matter. Lenses of organic matter may reflect ripples?

2 cm of clean, fine sand.

Thinly bedded clayey silt with fine sand. Laminae and thin whiskers of black, probably org. rich laminae. No apparent ripple structure. No burrows, no pebbles or shells.

Sand layer, possibly ripple bedding?

Clay-homogenous between C-14 23-3 sup spl

Organic rich bedded clayey silt

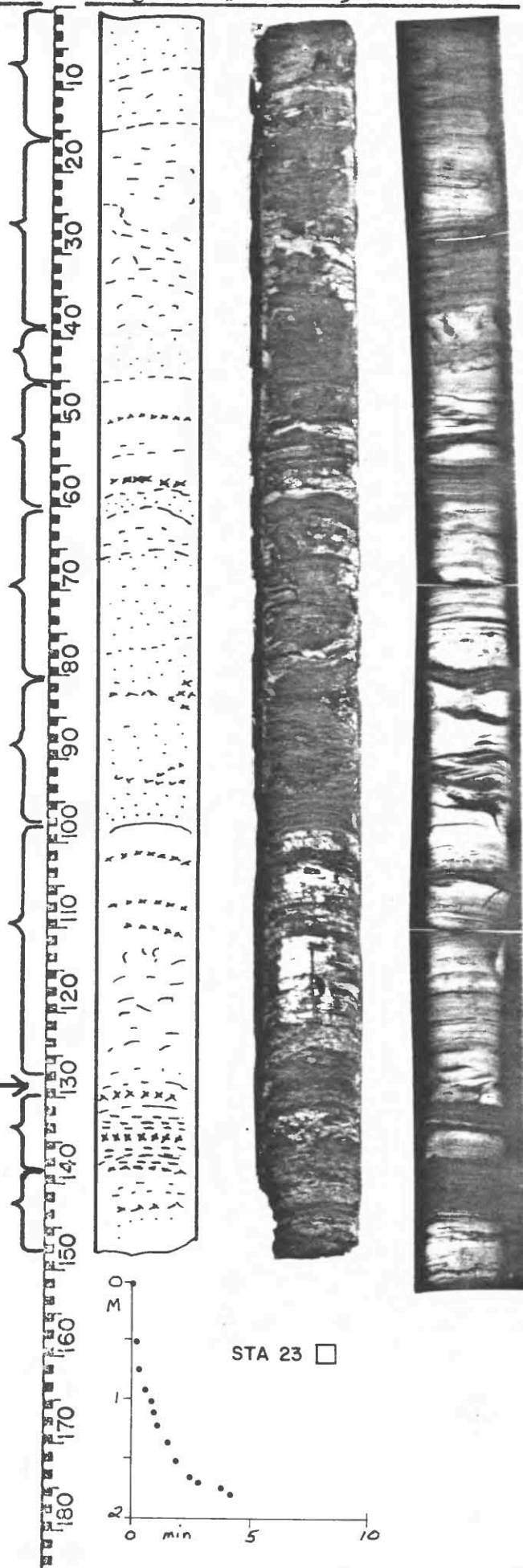
sand layer, perhaps ripple structures thinly bedded silt.

C-14 23-2 sub spl

C¹⁴ subsamples

130-133 cm 3430 ± 45 y

140-145 cm 3110 ± 70 y

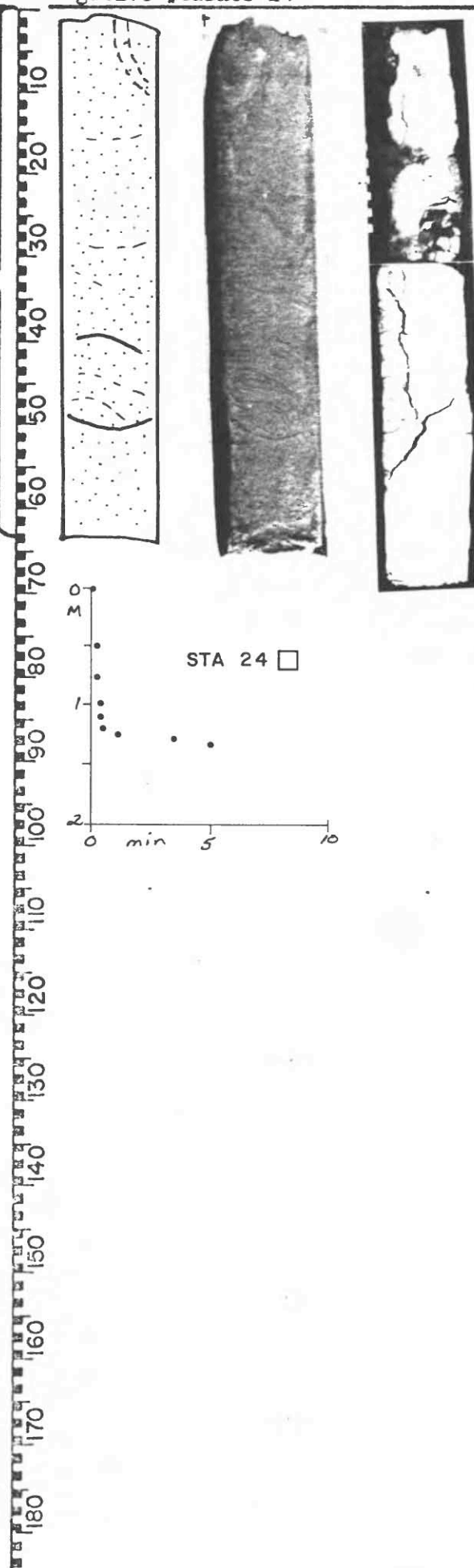


Core V-23 Depth 1 m 70°29.5'N, 150°59.5'W Remarks: N.W. of Colville delta

Slightly darker, fine to medium sand with dashed lines.

Medium to coarse, slightly oxidized, clean, homogenous sand, no structures visible except possibly the two sketched lines, representing somewhat finer sand

*Note: No pebbles, no shells.
No core catcher used, some material slid out, but penetration stopped on something over 1 m down into ridge.*





Negative #Barnes-25



Core V-25 Depth: 2.3 m 70°18.85N 148°21.9W Remarks: Southeast Prudhoe Bay

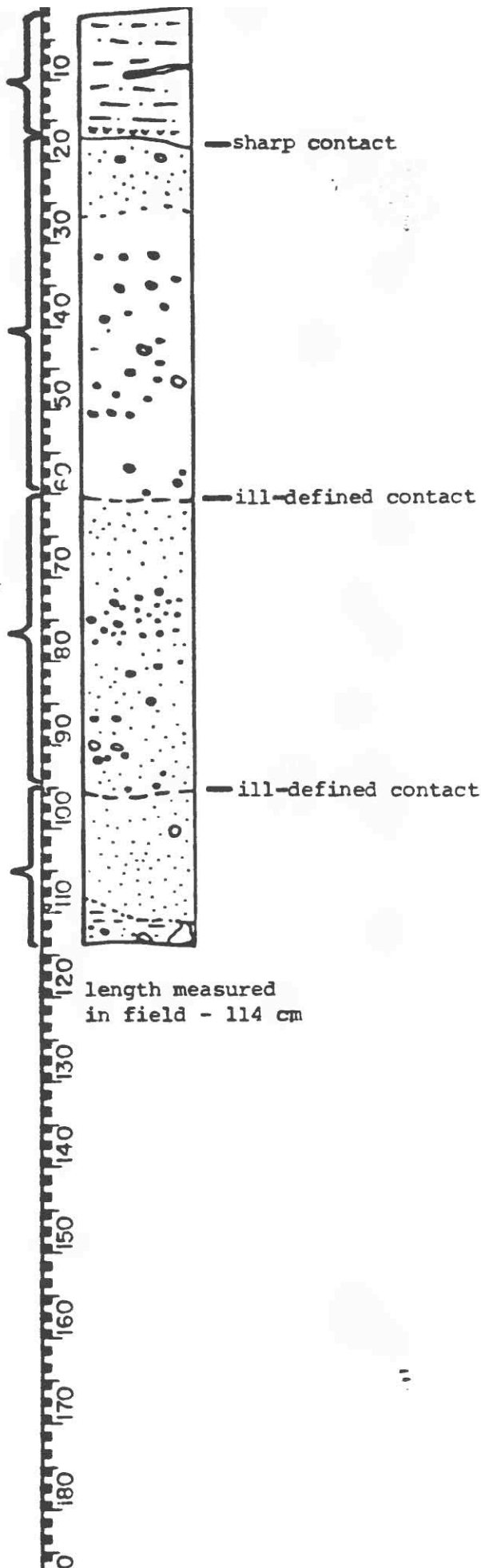
Core V-25

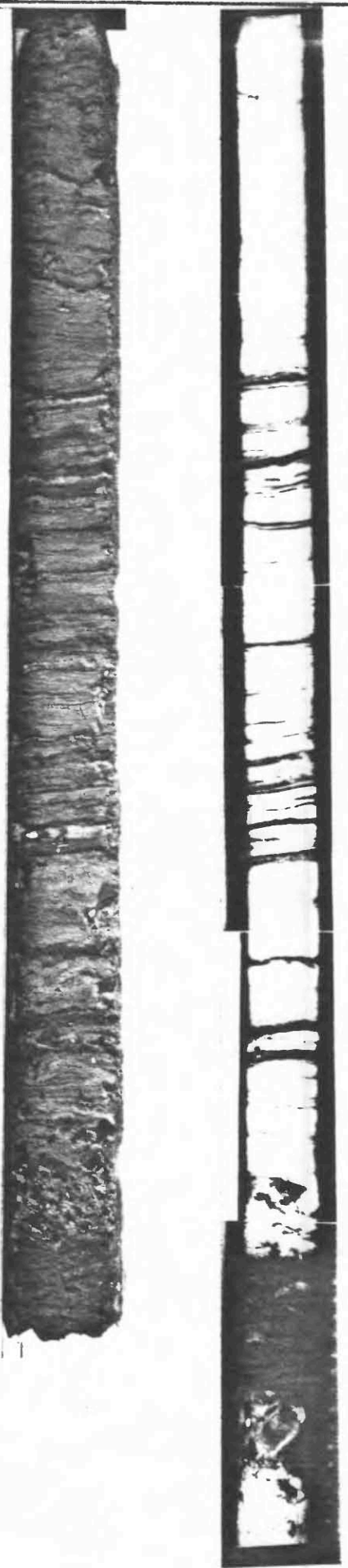
Thinly laminated sandy silt with small pockets of sand (in sketch), with pebbles up to 15 mm at 8 cm. Lower 4 cm has some fibrous organic matter.

Very muddy highly indurated to cohesive sandy gravel, several shell fragments under 5 cm, the lower 5 cm (54-59) is thinly bedded pebbly sand - clasts up to 15 mm.

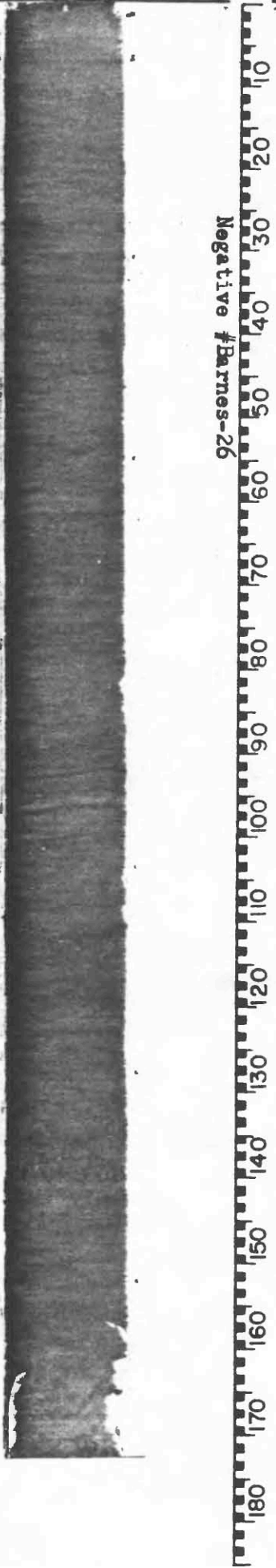
Clean, oxidized, gravelly sand - lower two thirds coarsening upward - clasts to 40 mm - no shells noted. From 90-95 - fine horizontal bedding.

Clean, medium sand with several granule size clasts and 1 pebble. Trace of fine horizontal lamination - sharp contact at 110 cm with muddy, sandy gravel.





Negative # Barnes-26



Core V-26 Depth: 1.5 m 70°19.5N 148°26.1W Remarks: Near Mouth of Putuligayuk River

Core V-26

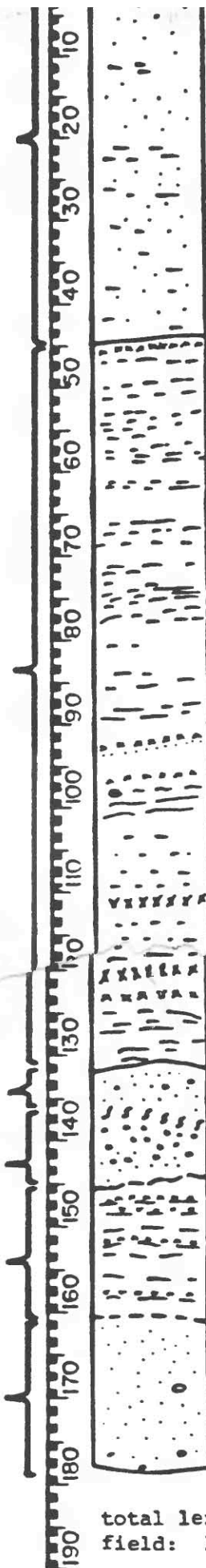
Slightly sandy silt with horizontal bedding, small packets of ripple structures, few scattered small pebbles and fragile shell fragments and intact shells, traces of organic material

Sandy silt with fine but up to 20 mm thick fibrous organic layers, silt is well laminated to very well laminated in most parts.

fine to medium sand with a few scattered pebbles.
 poorly sorted, gravelly, medium sand with angular clasts up to 15 mm with some fibrous organic matter

Silty peat with horizontal laminations, few pebbles.

Medium-grained, well sorted sand with scattered rounded pebbles - no visible structures.



Vane Shear -- Top
 peak 1.2 knt/m²
 residual 1.2 knt/m²

scattered granules in 15 mm sand unit

5 mm fine sand unit
 steeply dipping ripple laminations (ESE dip) - small bivalve 96-98 cm
 5 and 20 mm pebbles

contorted bedding

Contorted - gradational contact

contorted

subsampled for C¹⁴

ill-defined contact

Vane Shear -- Bottom
 peak 3.9 knt/m²
 residual 2.3 knt/m²

total length measured in field: 183 cm

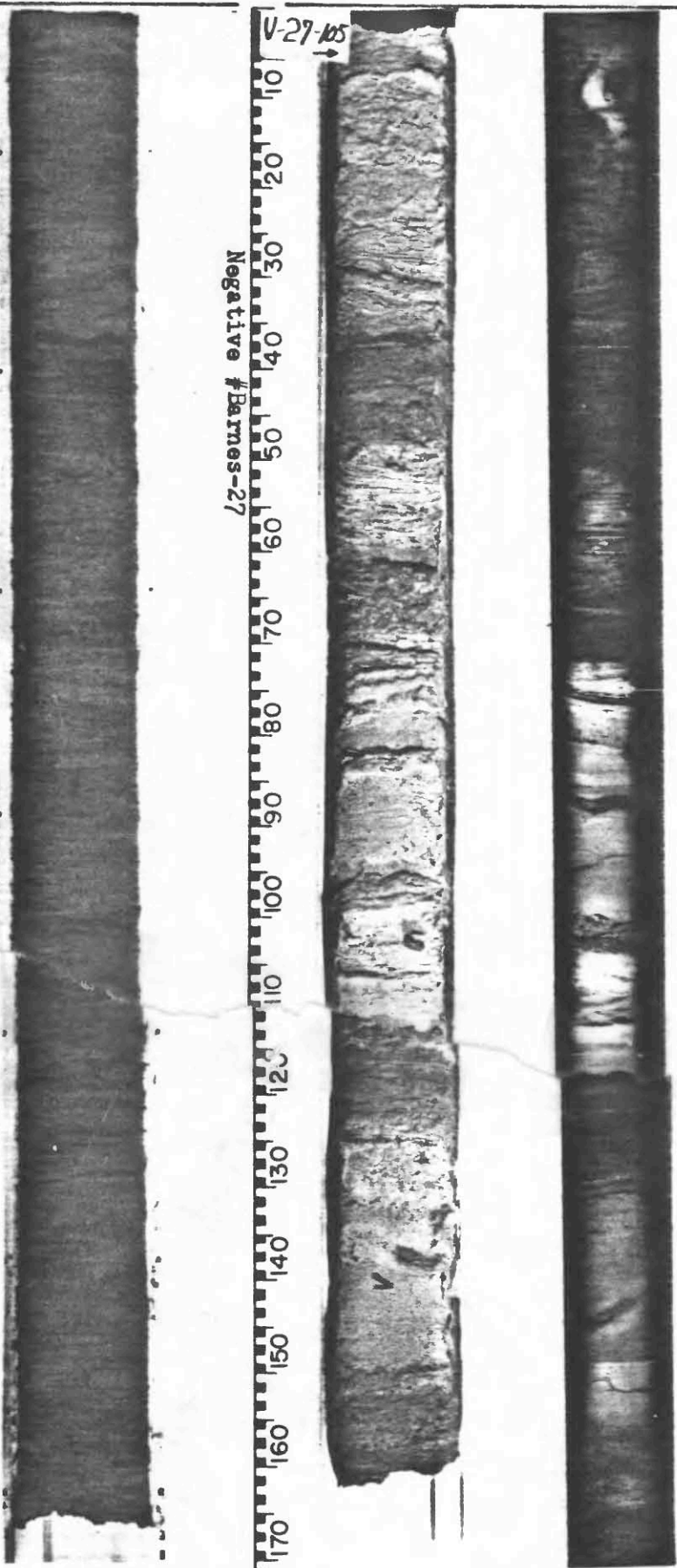
Core V-26 Depth: 1.5 m 70°19.5N 148°26.1W Remarks: Near Mouth of Putuligayuk River

Core V-26

V-27-105

Negative # Barnes-27

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18



Core V-27 Depth: 1.3 m 70° 25.77N 148° 43.3W, Remarks: Off Kuparuk River West of Point Storkersen Core V-27

burrowing in upper 3 cm and at 6-24 cm (Polychaete?) From 3-6 and 24-30 cm ripple bedding in cleaner sand - scattered granules throughout to 3 mm - worm remnants to 16.5 cm.

Noted live worms (to 16 cm) when core was cut.

Very organic-rich laminated sandy silt

Ripple-bedded or cross-bedded clean medium sand

Coarse, fibrous organic matter well-preserved - interbedded with very fine sand and 2 cm unit of organic-rich silt.

Medium to fine sand, horizontally laminated with abundant fibrous organic matter along bedding planes.

Well-bedded almost pure, coarse fibrous organic matter.

Fine to medium sand with organics along bedding planes.

4 units - beds of generally clean fine sand originally horizontally laminated or ripple-bedded now in parts homogenized by burrowing - occasional granules up to 3 mm,

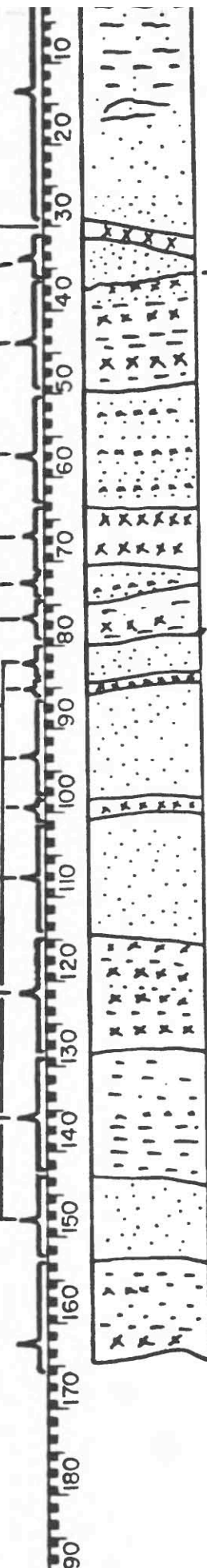
Horizontally bedded - partly disrupted, very organic-rich sandy silt. 3 units

very organic-rich finely laminated (smooth to ripple-bedded) cohesive sandy silt, with several well-rounded granules along bedding plane at 116 cm, rip-up at surface of unit.

Finely laminated to cross laminated fine muddy sand with scattered fibrous organic matter

Horizontally laminated silty fibrous organic matter - rip up at surface of unit.

Note: "Typical" Delta Sequence but more 'peat' and thicker 'peat' units than in Colville.



Note:
no shells seen in core

uneven, possibly rip-up contact
Sub-sample C¹⁴ and bugs.

Sub-sample C¹⁴

ball of organic matter
.5 cm layer of fibrous organics

Sub-sample C¹⁴
granules

stick

Vane Shear -- Bottom

peak >9.5 knt/m²
residual 8.7 knt/m²

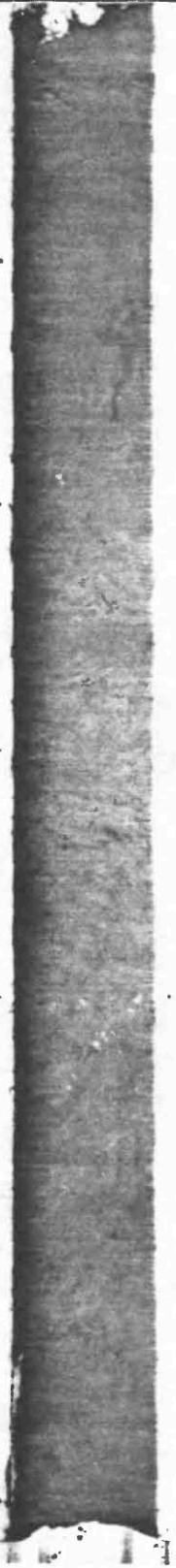
Sub-sample C¹⁴

Note:
4 organic layers would be ideal for dating



01 02 03 04 05 09 07 08 09 00 11 02 13 04 15 09 17 180

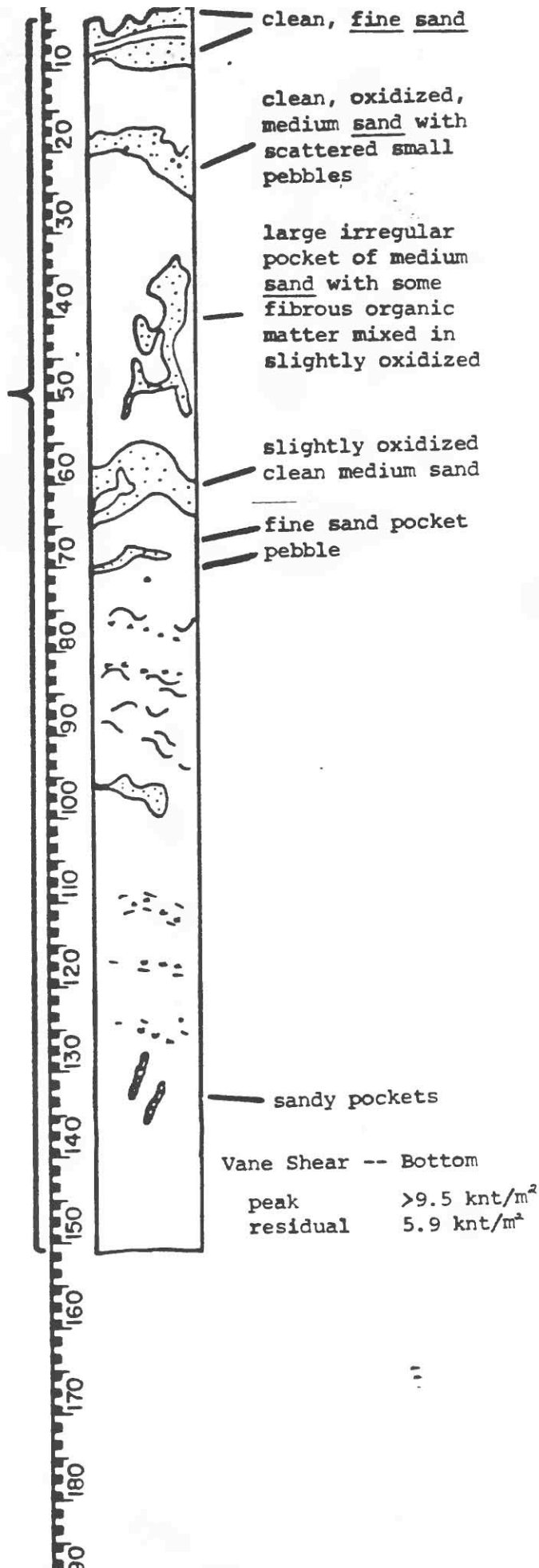
Negative # Barnes-28



Core V-28 Depth: 1 m 70°25.28N 148°41.9W, Remarks: Inside Egg Island Near Pt. Stokersen Core V-28

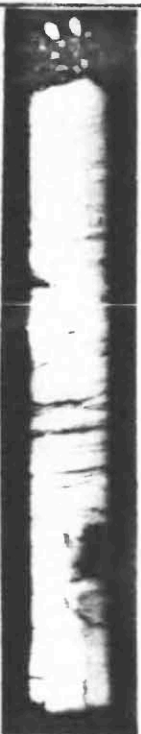
Except for sand pockets:
Highly contorted fine slightly
muddy and cohesive sand with
few scattered, rounded pebbles
and granules, less than 1 cm -
scattered fibrous organic debris
scattered small fragile shell
fragments including Cyrtodaria.
Distinctly cleaner and less co-
hesive in upper 60 cm.

Sand pockets: as noted - only
traces of primary structures
preserved in sand pockets.



Core V-28 Depth: 1 m 70°25.28N 148°41.9W Remarks: Inside Egg Island Near Pt. Stokersen

Core V



01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18

Negative #Barnes-29

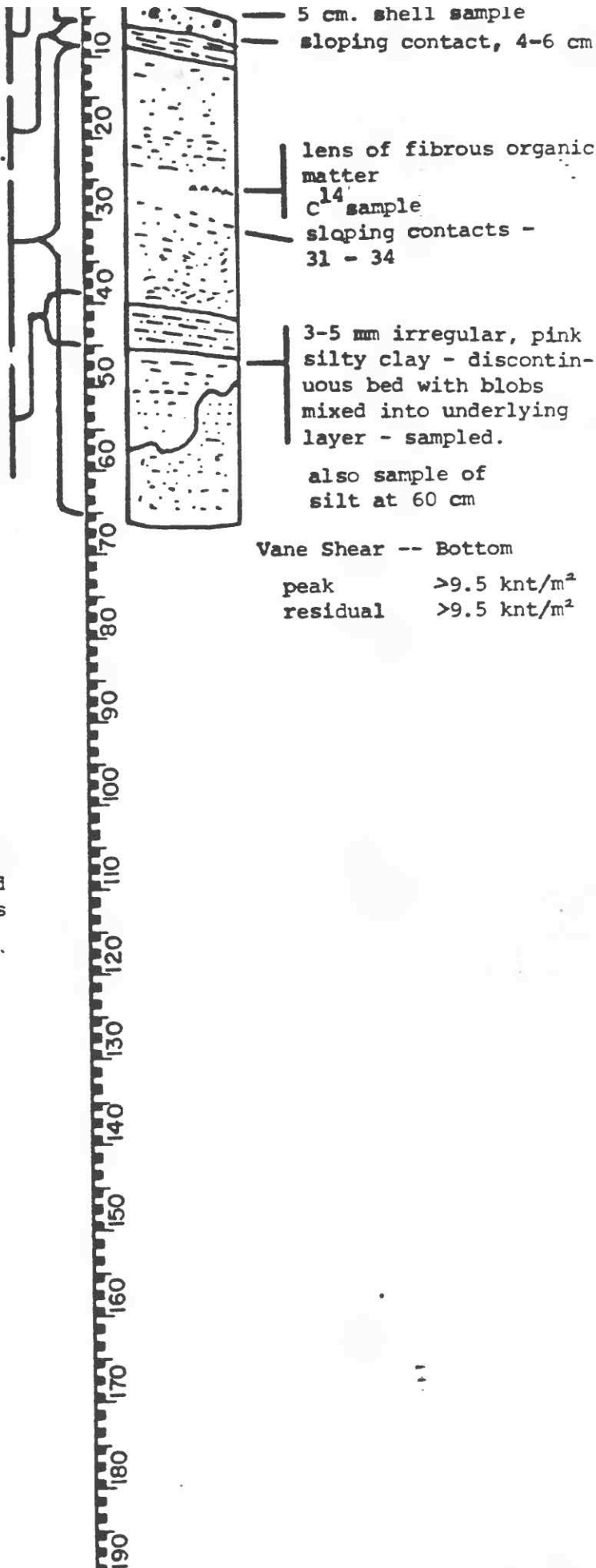
Core V-29 Depth: 5.5 m 70°24.03N 138°00.2W Remarks: Center, Stefansson Sound

Core V-29

with few shells - no structure, sharp irregularities. Rip-up contact with underlying silt unit. Very stiff, mottled to poorly-bedded silty clay with shell fragments in places - fewer shells at depth in core.

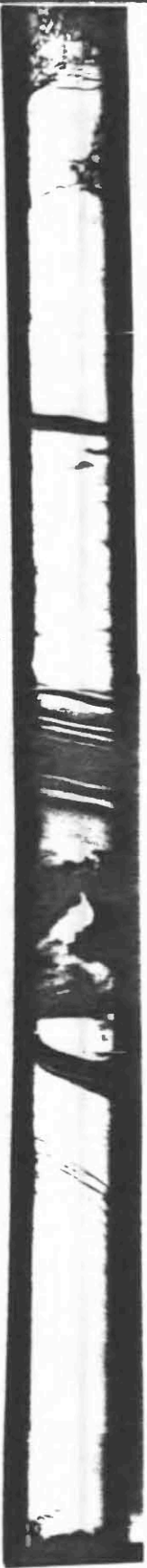
Stiff clayey silt - faintly bedded to contorted and bioturbated - including faint, thin sand lamina. interbedded with units of clean, fine ripple-bedded sand - to silty sand, several cm thick, generally overlain by clean, homogenous fine sand.

Horizontally laminated sandy silt, interbedded with laminated organic-rich sandy silt.



Note: It appears that the sand pockets were deposited after a pulse (?) of strong current eroded a stiff clay surface. The upper surface of this sand unit was initially rippled but became smoothed by the ensuing cycle of quiet water deposition.

Note: Significant change in environment between stiff clay and overlying pebbly sand (hiatus?) - no sand worked down into silt (burrows) nor mud balls into overlying sand.
5 cm shell



Negative # Barnes-30

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18



Core V-30 Depth: 1.5 m, 70°22.1N 148°05.93 Remarks: Western Sagavanirktok Delta

Core V-30

Clean, fine sand, fine cross-bedding in upper 10 cm. Rather well-preserved except for some burrowing structures disturbed below 10 cm. 18 - 30 cm contains some mud balls - upper 10 cm has very small shells.

Muddy, fine sand - faint horizontal bedding, small shell fragments.

Fine sand with ripple structures.

Muddy sand - interbedded with very muddy sand.

Fine sand with well-preserved ripple structure with some vertical, small burrows (polychaete?)

Interbedded - highly muddy, very fine sands with thin clean sands fibrous organic layer at top of unit.

Cross-bedded fine sand - clean.

Interbedded clay-silt and organic-rich layers, with the silt layers becoming thinner at base of unit. Silts are finely laminated. The unit is almost entirely organic at the base.

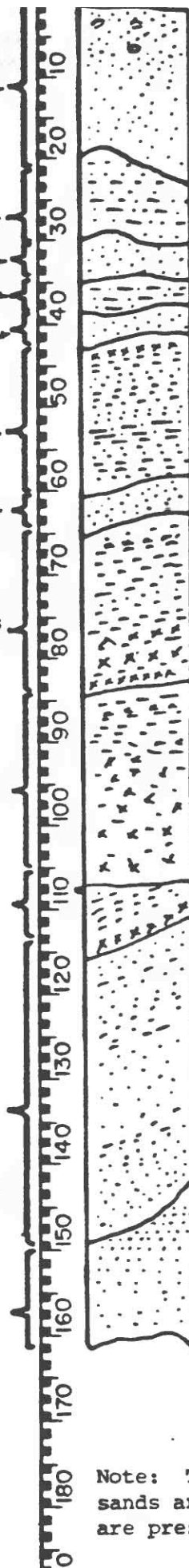
Fibrous organic matter almost pure organics disrupted - slight admixture of silts in upper 10 cm

Interbedded muddy silt and fibrous organic matter, dip of beds increases toward base. Ripple beds at base of unit.

Finely laminated medium sand and medium muddy sand, ripple bedding in upper 7 cm. Below 120 cm fibrous organic matter and a few mud balls along bedding planes - increasing numbers of angular, small mud lumps in lower 10 cm up to 1 cm - generally platy

Finely laminated clean, medium sand. Smooth or very smooth horizontal laminations.

Not a single pebble in core.
Conspicuous absence of shells.



20 - 23 cm irregular contact

sharp contact

mud infills, ripples

irregular contact

rip-up material
(High velocity current?)

smooth, sloping contact

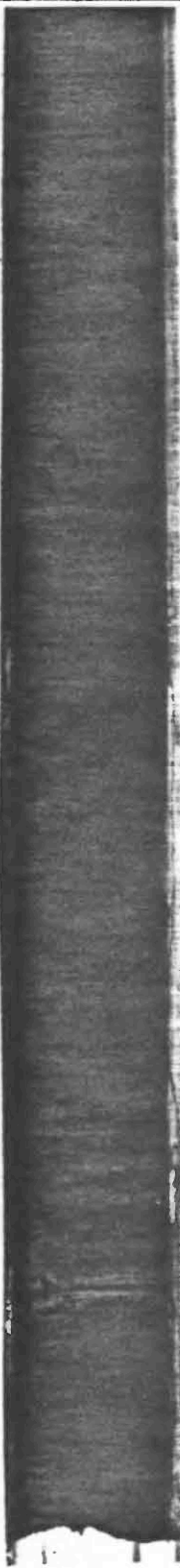
sloping, smooth contact

sharp, sloping contact

Vane Shear -- Bottom

peak 4.4 knt/m²
residual 1.9 knt/m²

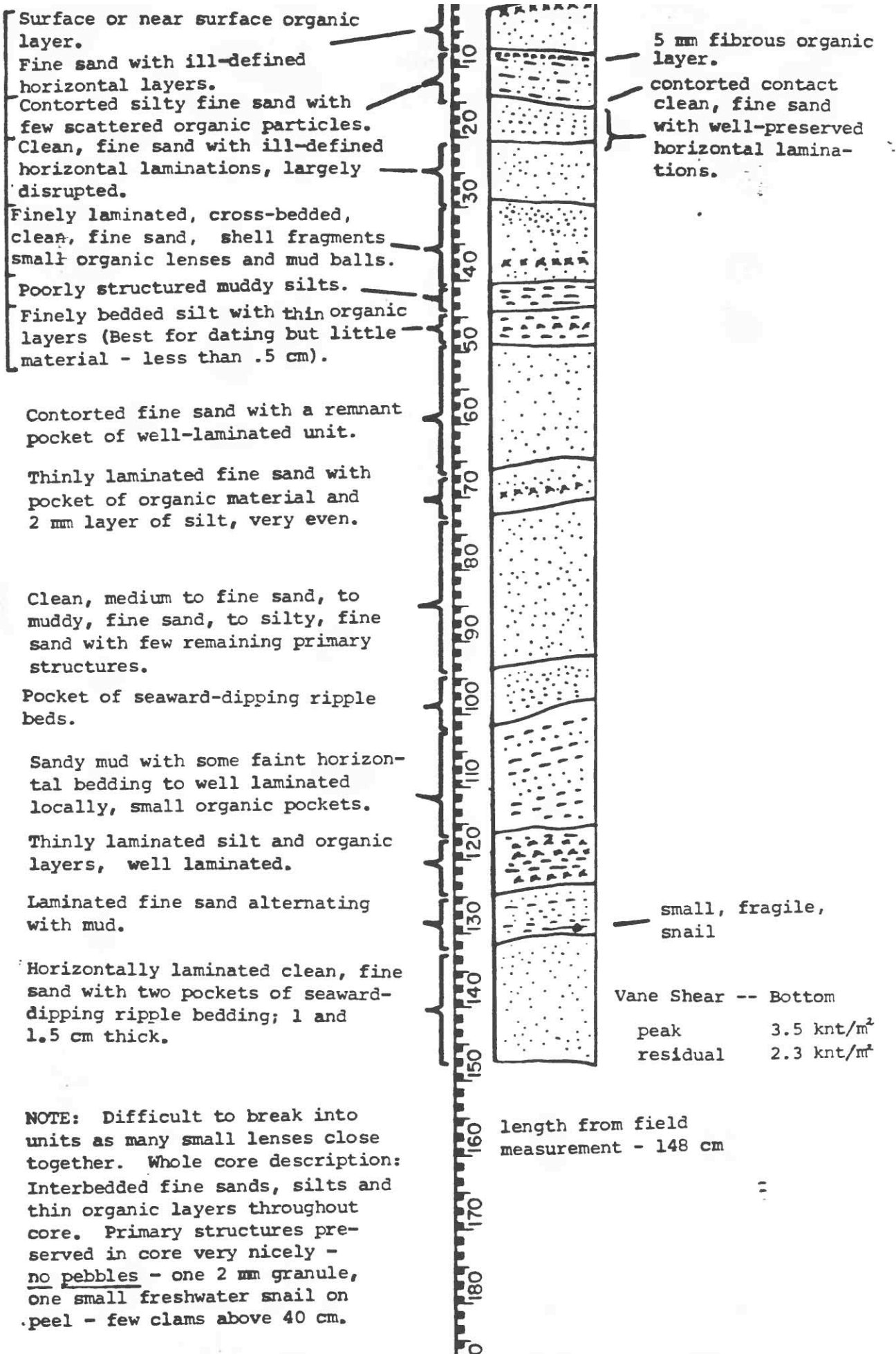
Note: Typical delta section except sands are at base, and more peats are present than to the east. (V-31)



Negative # Barnes-31

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18

Core V-31, Depth: 1.3 m, 70°19.9N, 147°54.05W, Remarks: Off eastern part of Sagavanirktok Delta Core V-31

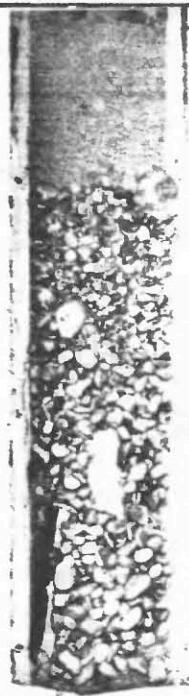


Core V-31 , Depth: 1.3 m, 70°19.9N, 147°54.05W, Remarks: Off eastern part of Sagvanirktok Delta

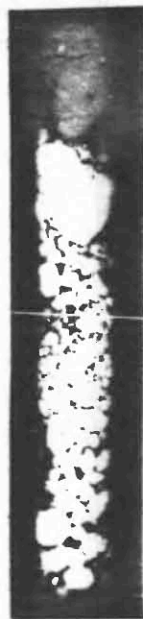
Core V.

Core V-34 North. E m 70000 71N 147000 51W Remarks: North off Narwhal Island Beach

Core V-34



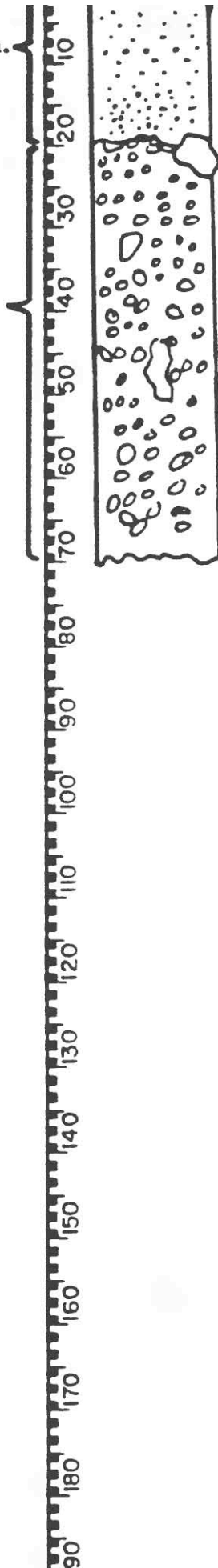
Negative # Barnes-32



Coarse pebbly sand showing trace of bedding throughout, granules to 7 mm. Sand is sub-rounded - lamination at base.

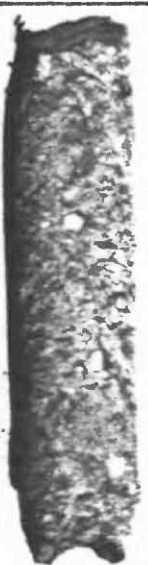
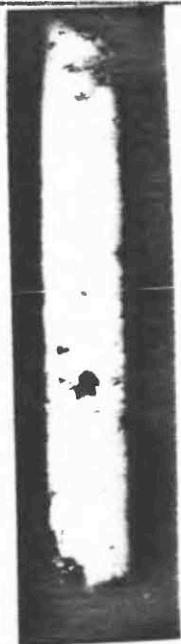
Clean, rounded granules - fining upwards - clasts up to 13 cm in length.

Subsamples for lithology studies.



Core V-34 Depth: 5 m 70°23.74N 147°28.5W Remarks: North off Narwhal Island Beach

Core



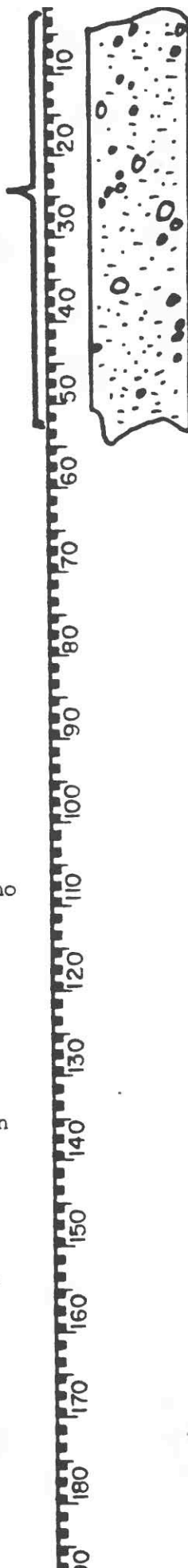
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180

Negative # Barnes-33



Core V-35, Depth: 19 m, 70°29.1N 147°36.8W Remarks: From gouge area NW Narwhal outside break in slope Core V-35

Hash of poorly sorted mixture of coarse, highly angular to rounded gravel to clay; highly compacted, clasts to 6.5 cm in core (15 cm on anchor flukes). A few shell fragments - unbroken fragile shell (2.5 mm) sampled at 40 cm. No trace of stratification. Very highly compacted material.



Notes: is this glacial outwash with whole marine shells? No marine growth on anchor fluke material. Inshore, no core - on gouged area - (V-36) - material even more compacted?

Also to the east - V-32 and 33 no cores with several attempts.

Inshore V-32 - 2 barrels

Vibrate time	Penetration
3 min 30 sec	24 cm
6 min 40 sec	45 cm

no core

Offshore V-33 - 1 attempt - 1 min 45 sec - 12 cm of penetration.

No core

T-probe - 3 min 30 sec - .85 m of penetration

V-36 - 2 attempts - 3 min 30 sec 17 cm of penetration

no core

Core V-35

Core V-35, Depth: 19 m, 70°29.1N, 147°36.8W Rmks: From gouge area NW Narwhal outside break in slope

Core V-35, Depth: 19 m, 70°29.1N, 147°36.8W Rmks: From gouge area NW Narwhal outside break in slope



Negative # Barnes-34

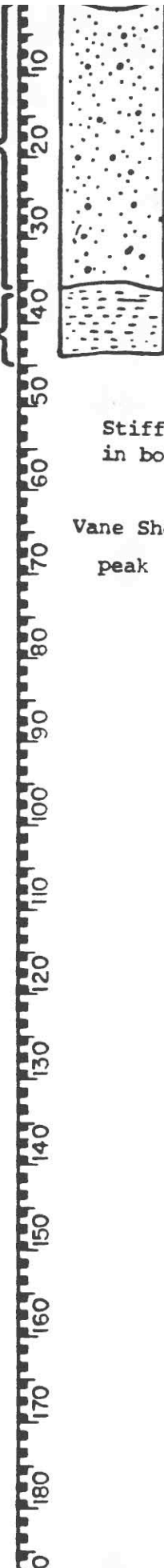
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180

Core V-37, Depth: 10 m, 70°29.25N 148°09 W, Remarks: Northeast of Argo Island

Core V-37

Well-sorted clean, medium to fine sand, with scattered, well-rounded granules and small pebbles - mainly in upper 4 cm; lumps of fine sandy mud up to 4 cm - flattened laminations and cross bedding in sand - very disrupted probably due to interaction with core catcher during core extraction. Intact laminations below 31 cm. A single worm tube at 12 cm.

Light grey, clayey silt with faint indications of primary laminations at 1 - 2 mm interval. More pronounced in upper 3 cm suggesting no re-working by gouging.



Very sharp contact possibly with rip-up.

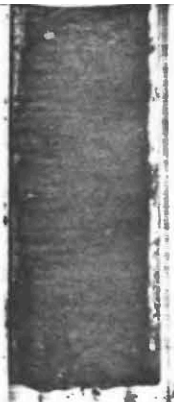
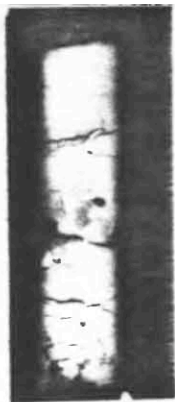
Stiff, silty clay in bottom

Vane Shear -- Bottom

peak $>9.5 \text{ knt/m}^2$

Core V-37, Depth: 10 m, 70°29.25N 148°09W Rmks: Northeast of Argo Island

Core V-3

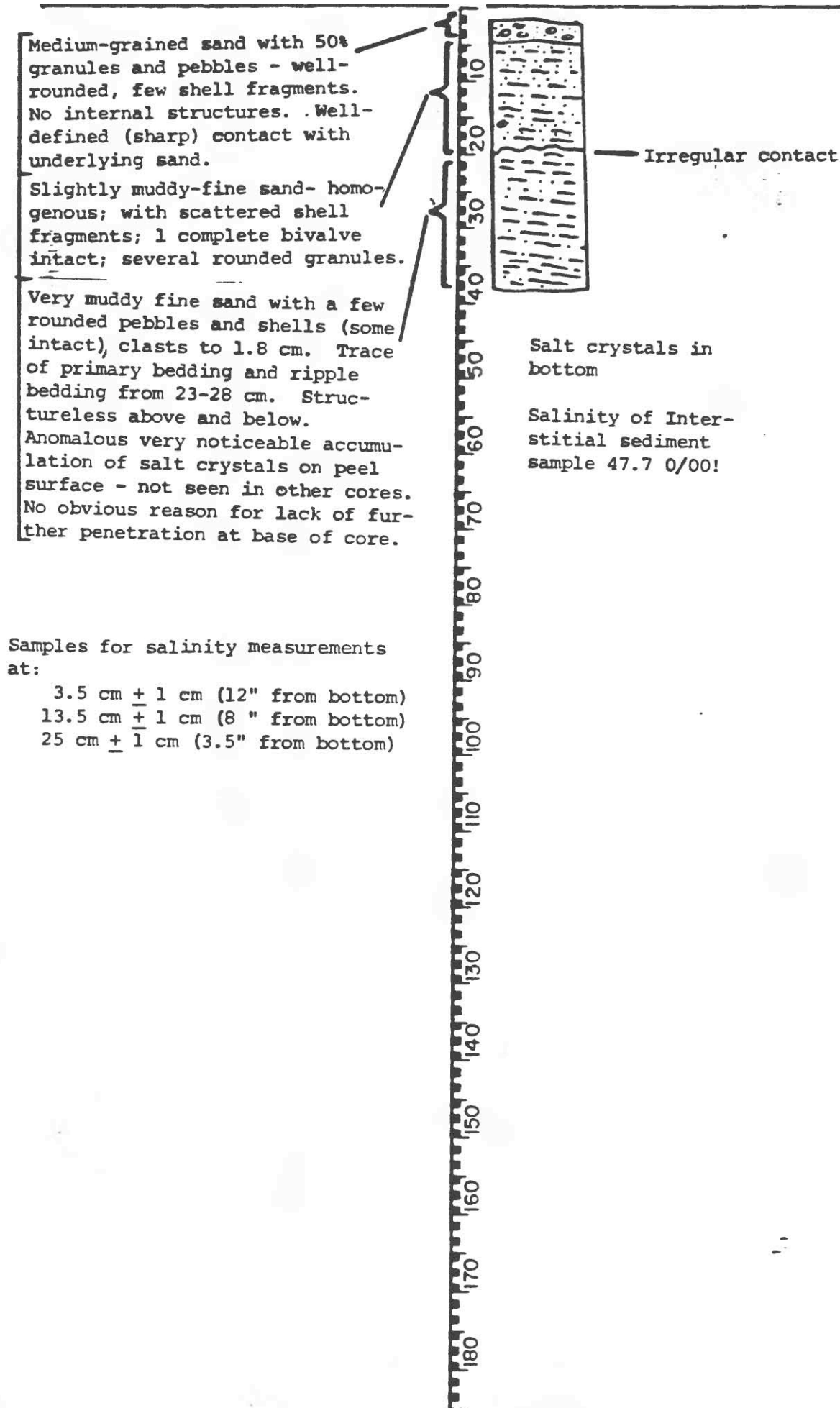


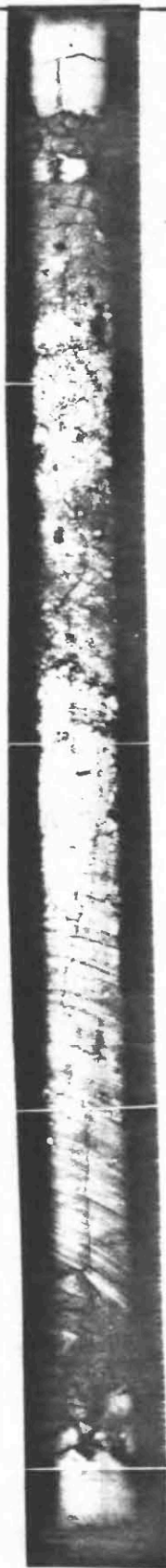
Negative # Barnes-35

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180

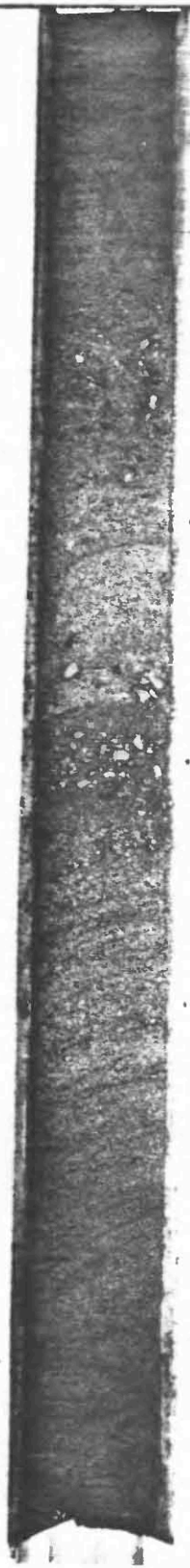
Core V-38 North. 4.6 m. 70°29.25N 148°17.7W Remarks: North of Reindeer Island

Core V-38





Negative # Barnes-36



Core V-39, Depth: 4.5 m, 70°28.68N 148°21.5W, Remarks: Inside Reindeer Island

Core V-39

Stiff grey muddy fine sand with a few scattered granules, intensely bioturbated, polychaetes, lacking primary bedding structures - basal contacts of both units very bioturbated.

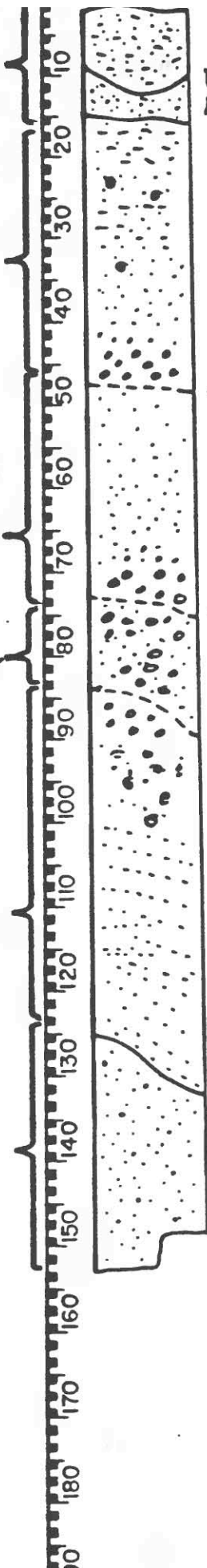
Entire unit highly disrupted, especially in upper part. Poorly sorted medium sand with scattered granules, pebbles, shells, and a few silt lenses in the upper 5 cm. Sand becomes coarser and decreases in quantity with depth while gravel increases downward to a slightly sandy gravel at base - maximum clast 35 mm. Some shell fragments intact. Sand units were probably horizontally bedded but are now deformed into flame structures.

Poorly sorted bedded granular, coarse sand, becoming coarser with the addition of rounded pebbles toward the base. Bedding tilted 20° (probably an artifact of coring). No shells seen. Maximum clasts at base 25 mm.

Homogenous sandy gravel with ill-defined boundaries - clasts generally rounded (beach?). Maximum clasts 30 mm. No shells.

Poorly sorted, bedded, gravelly to granular sand fining downward to well-sorted, bedded, fine sand - few granules, cross-bedded units at 114-120 cm. No shells. Bedding planes about 2 mm thick now tilted at 20-30° (artifact of coring sand loss?)

Highly disrupted fine to medium sand with few granules and small pebbles. Primary bedding planes locally preserved. No shells. Unit has a slight admixture of silt. Also a 2-3 mm sandy mud layer.



Slightly muddy, medium to fine sand with granules, small pebbles, and shell fragments similar to material below the underlying mud layer.

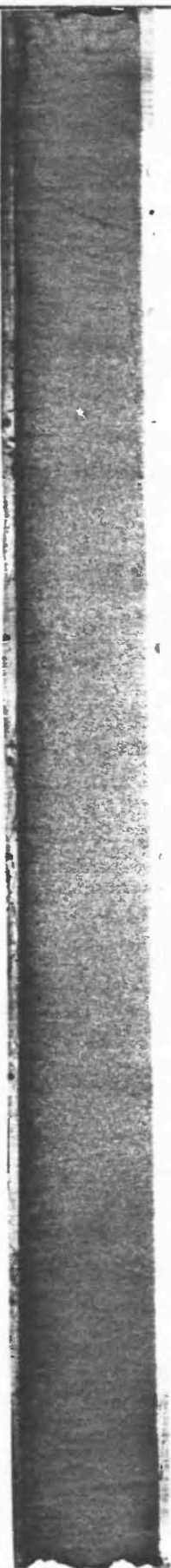
Indistinct contact

Indistinct contact

Dipping contact

Negative # Barnes-37

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18



Core V-40, Depth: 1 m, 70°28.9N 148°21.6W, Remarks: Inside Reindeer Island on transect

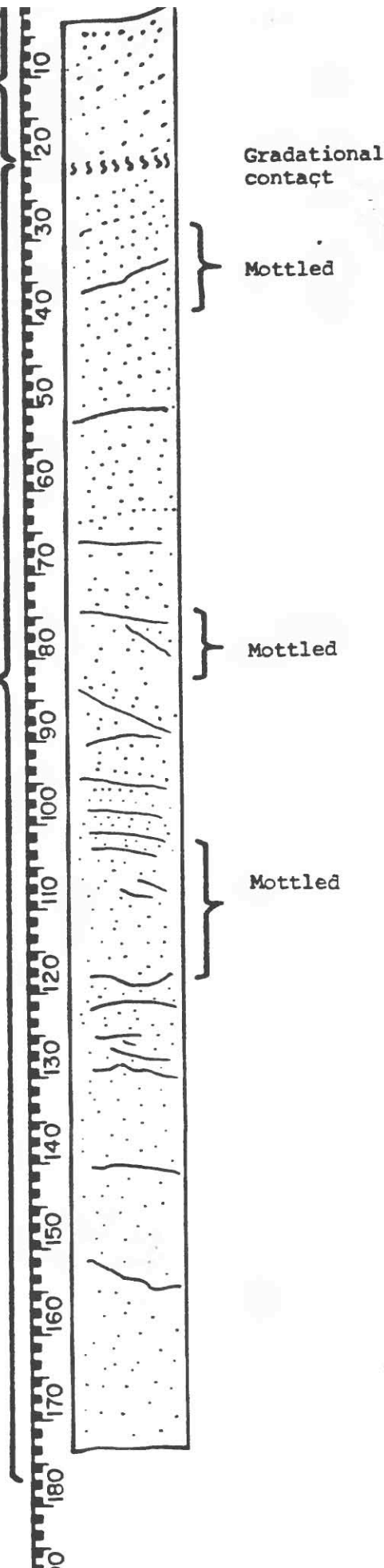
Core V-40

Medium to coarse-grained sand with a few scattered granules. Inclined bedding, originally horizontal laminations 1-2 mm apart. Now inclined to 10-25°. Granule lens 5 mm thick at about 15 cm.

Well-sorted clean, medium sand with very few granules and a few small shell fragments. Generally smooth horizontal bedding with 1-2 mm spacing.

Ripple bedding at 28 cm, 70 cm, 100 cm, 135 cm, and 150 cm. Slight variability in dip of bedding seen in radiograph may be related to strudle-type scours (2-5 m in diam.) seen inside Reindeer Island (1976). Similar to V-5 but less cross bedding seen in this core.

At 27-40 cm, 73-82 cm, 102-120 cm mottled structures, possibly related to polychaete worm field.





4-A 156

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 180

Negative # Barnes-38



Core V-41, Depth: 2.45 m, 70°28.7N, 148°18.1W, Remarks: East end of Reindeer Island - Old Island location Core V-41

Medium to coarse, clean, pebbly sand, homogenous. Largest clast 8 mm. Rare shell fragments.

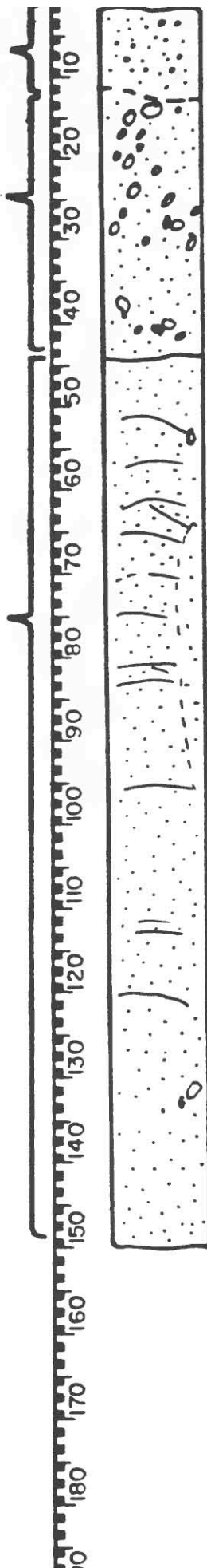
Structureless, coarse, pebbly sand. Rounded to sub-rounded clasts to approx. 35 mm, few shell fragments.

Medium to fine, clean sand, few scattered pebbles up to 30 mm - occurring to a depth of 70 cm - intact or semi-intact fragile shells throughout core.

Sand is well laminated with occasional pockets of ripple bedding.

2 cm wide drag down structure along 275° side of core.

Admixtures of silt below 135 cm, structures are somewhat disturbed.

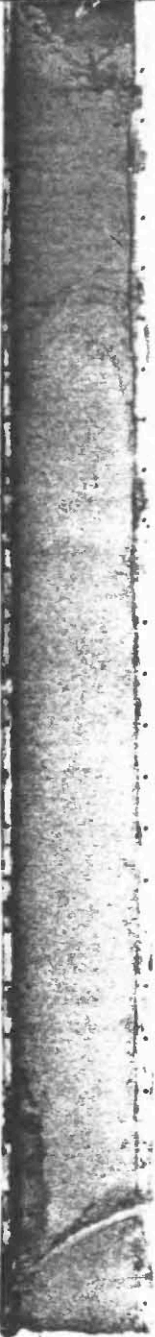




V-42 704

01 02 03 04 05 09 07 08 06 00 01 02 03 04 05 06 07 08

Negative # Barnes-39



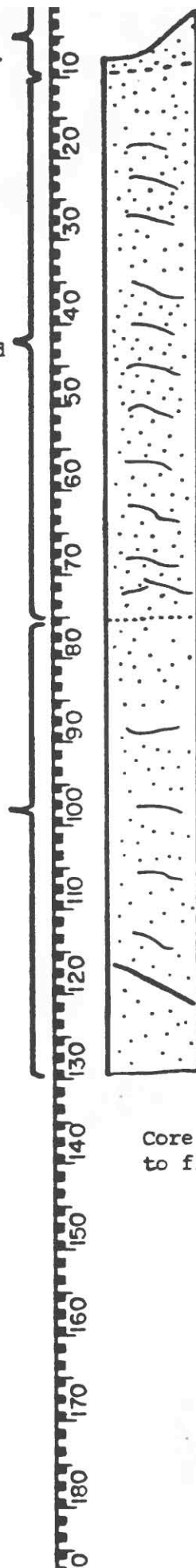
Core V-42, Depth: 5.3 m, 70°29.54N 148°20.8W Remarks: Between V-6 and V-8 off Reindeer Island Core V-42

Clean, light brown-grey medium,
well-sorted sand. Totally disrupted.

Clean, light brown/grey medium,
well-sorted sand with bedding planes
horizontal at 1-2 mm spacing. Sec-
tions with ripple bedding. Scattered
shell fragments, and granules from
47 cm downward, not along bedding
planes. No mud lumps. All primary
structures show core barrel down-
ward along side of core.

Same materials as above but primary
structures gradually disappearing
downward at 70-75 cm. Gradually -
how is not known. That is, no
obvious reason exists for homo-
geneity or gradual transition.

Slight mottling or pockmarking
seen on peel at 100-120 cm - not
on radiograph. Core catcher in
base.



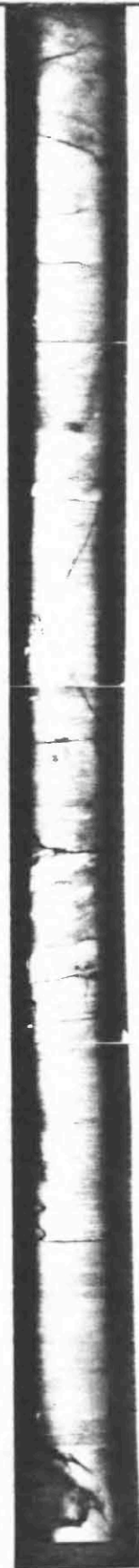
Gradual change

Core catcher

Core ended in gravel, according
to field notes.

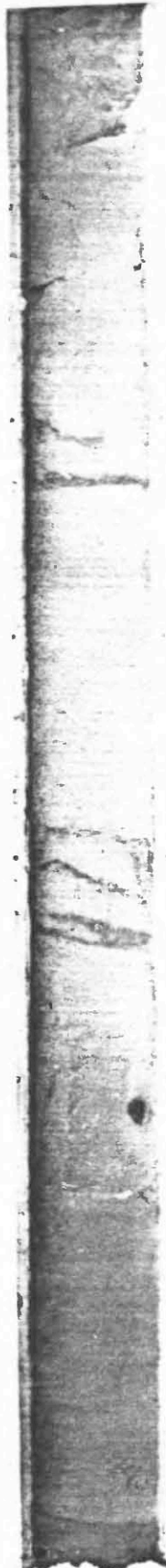
Core V-42, Depth: 5.3 m, 70°29.54N 148°20.8W Rmks: Between V-6 and V-8 off Reindeer Island

Core V.



Negative # Barnes-40

01 02 03 04 05 09 07 08 06 00 01 02 03 04 05 09 07 08



Core V-43 Depth: 12.7 m, 70°32.27N, 148°21.7W, Remarks: North of Reindeer Island

Core V-43

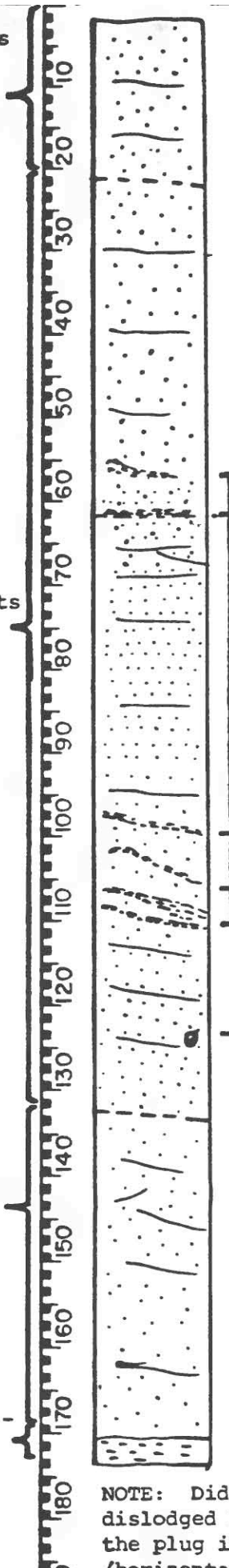
Clean fine sand with scattered granules up to 6 mm - thin 1.5 mm worm tubes (Polychaete).

Original structures probably disturbed during coring or core preparation.

Clean well-sorted fine sand, generally horizontally laminated, but with pockets of cross-bedding. Fragile shell fragments, mainly bivalves, throughout core, mud lumps to 1 cm along bedding planes.

Sand as above but slightly muddy and homogenized, shells are smaller fragments.

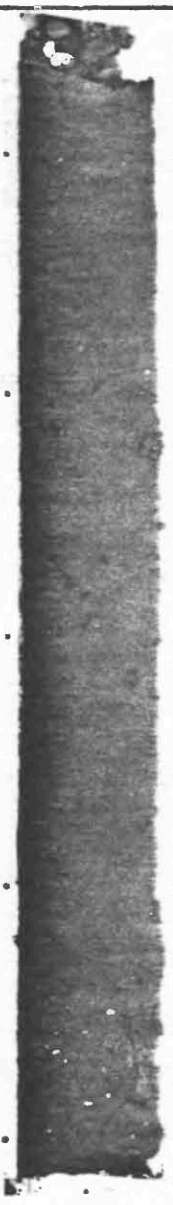
Slightly sandy clay silt - very stiff - sharp contact with overlying unit. Suggestion of primary structures and variations in clay content.



NOTE: Did not appear to run into any dislodged blocks of silty clay, thus the plug in bottom seems to be in situ (horizontal bedding)



Negative # Barnes-41



10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180

Core V-44 North. 12 75 m. 70°34.05N. 149°0. 65W. Remarks: Seaward side of ridge

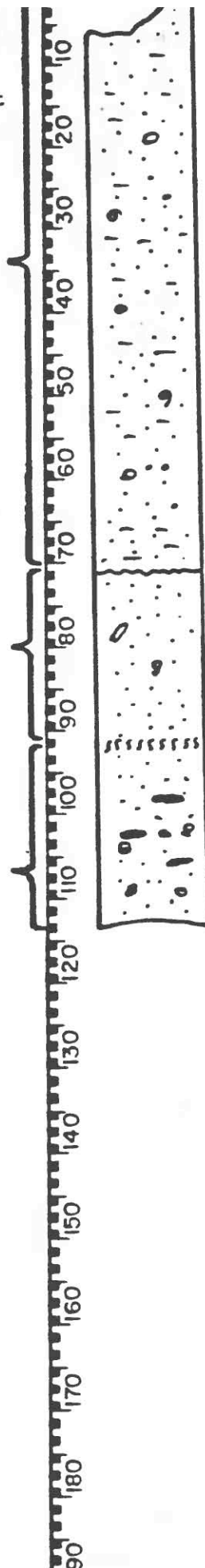
Core V-44

Fine to medium clean sand with faint traces of primary ripple structures in upper 15 cm - faint laminations seen throughout section; contains angular mud lumps up to 25 mm, shell fragments, mainly Astarte, plus a few scattered granules and pebbles up to 25 mm. Top very disturbed but apparently containing 10-15% mud mixed in.

Irregular contact at 71 m along crack. Sand slightly pinkish above and pale grey below, which lacks pebbles and granules. Unit is homogenous, clean, medium to fine sand with very few angular mud lumps and very fragile shell fragments.

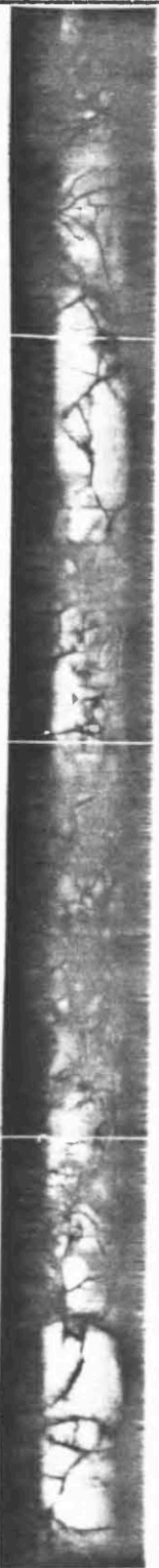
Fine to medium clean sand with abundant plate-like mud lumps oriented horizontally (possibly flattened by weight), coarse shell fragments, notably Astarte, and pebbles up to 50 mm - unit coarsening downward - mud lumps composed of either slightly cohesive silt or stiff, silty clay. Apparently not a lag deposit related to ridge migration across site.

NOTE: Finer-grained sand than encountered in V-45.



Core V-44, Depth: 12.75 m, 70°34.05N, 149°0.65W, Remarks: Seaward side of ridge

Core V-4



V-45 > 160

Negative # Barnes-42



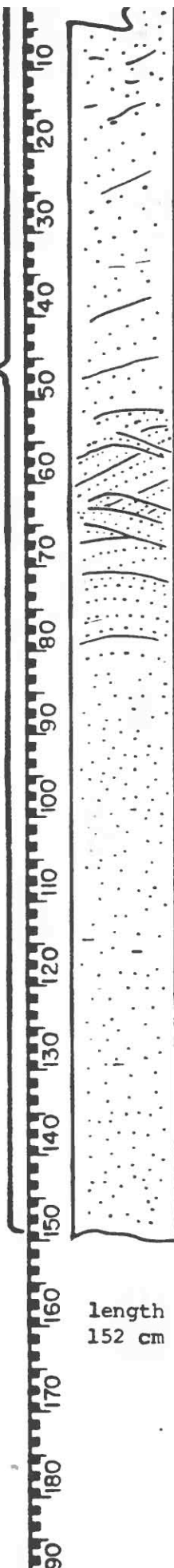
Core V-45 Depth: 6.7 m, Remarks: On ridge top south of V-44

Core V-45

Very clean medium to fine sand throughout entire core, several very small fragile shell fragments, not a single pebble, granule, mudlump or organic matter. Primary structures in upper part of core (to 80 cm) not preserved at depth (ice gouged?) - x-ray messed up during processing - useless!

Structures: the primary structures consist of parallel horizontal laminations to crossbedding - the latter could result from current ripples - 10 - 12 cm high or higher or from slip due to ice bulldozing.

approx. 30 cm
sample for
grain size

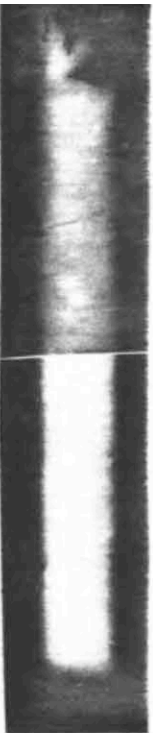


length in field
152 cm

Core V

Depth: 6.7 m, Remarks: On ridge top south of V-44

Core V-45



Negative # Barnes-43



Core V-46, Depth: 13.8 m, 70°33.75N, 149°01.3W, Remarks: Inside ridge

Core V-46

Slightly pebbly, cohesive clay, clasts from 1 mm granules to 15 mm, larger clasts rounded and smaller ones angular. Pockets of sand in upper 8 cm. Bedding, if originally present, in upper 40 cm. It is presently disrupted and contorted - trace of horizontal bedding in lower 15 cm. No fibrous organic matter or shells. Rounded gravels in core nose not retained.

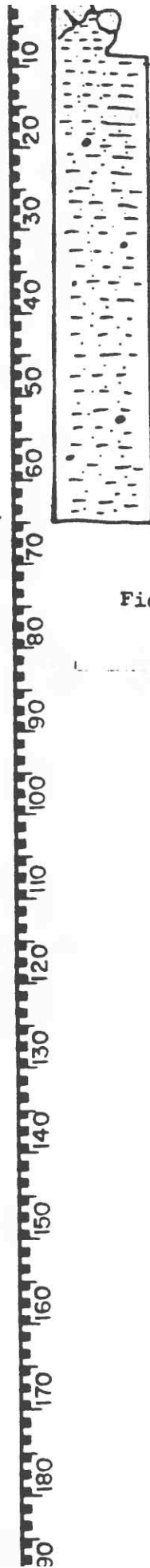
upper 5 - 7 cm
disrupted making
core too long

Core V-46

Field Observation of Base of Core:
Stiff mud with rounded gravels

Field length - 59 cm

Core V-46, Depth: 13.8 m, 70°33.75N, 149°01.3W, Rmks: Inside ridge



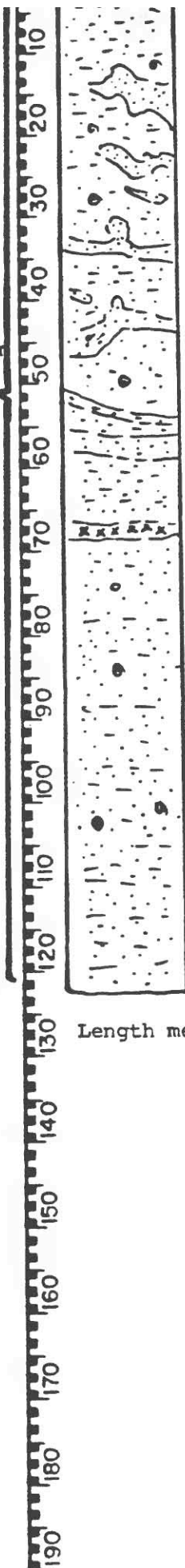


Negative #Barnes-44



Very fine silty sand alternating with 2-4 cm unit of fine to medium silty sand - few scattered pebbles up to 15 mm. Original structures largely contorted - when dry a sample has little cohesion - upper 14 cm is a fine, horizontal layering preserved - worm tubes extending 7-8 cm. Finely laminated sand unit at 7-9 cm. Lack of pronounced current ripple features throughout. Scattered fibrous, organic material along with Cyrtodaria scattered throughout. Most are intact suggesting a quiet environment (both valves) 'estimate' less than 100 pebbles in the whole core.

A.S. Naidu sub-sampled archive 1/2

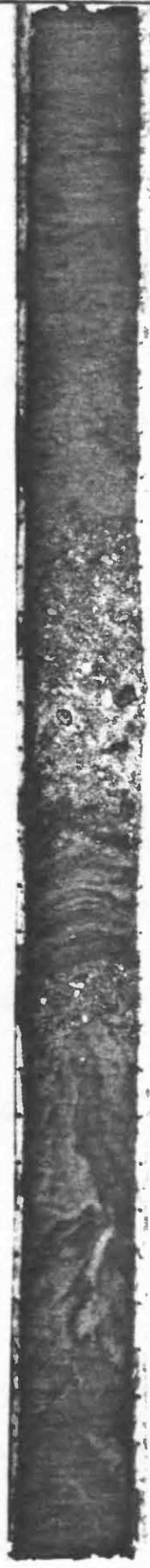


Fresh-appearing very fibrous organic peat layer

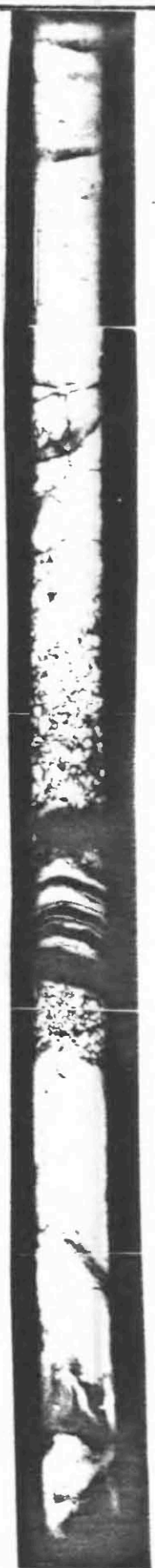
Subsamples for C¹⁴ min. spl.

Pebble

Length measured in field - 122 cm.



Negative # Barnes-45



Silty medium sand, coarse bedding in upper 15 cm. Polychaete worm tubes (?) upper 8 cm. Small, irregular pocket of medium sand, scattered fibrous organic pieces pebbles to 8 mm (several).

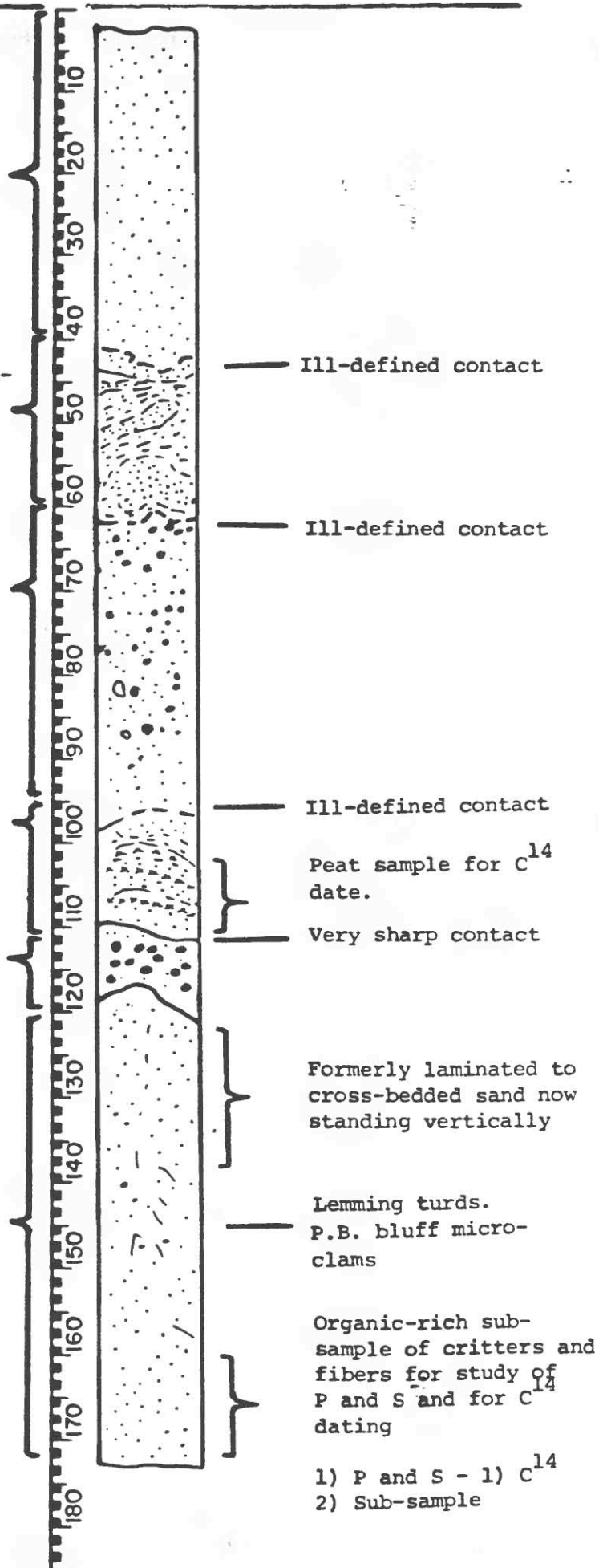
Slightly pebbly, clean sand with silty, irregular pockets, disrupted horizontal bedding in upper 3 cm, largest clast 4 mm.

Very gravelly medium to coarse-grained sand (beach) with some shell fragments - coarsening upward. No structure. Maximum clast size: 30 mm

2 - 4 cm thick fibrous organic matter (peat, the upper layer with sticks) - interbedded with clean, medium sand without structure. Peat layers are well bedded and contain thin mud and sand layers (CF-49).

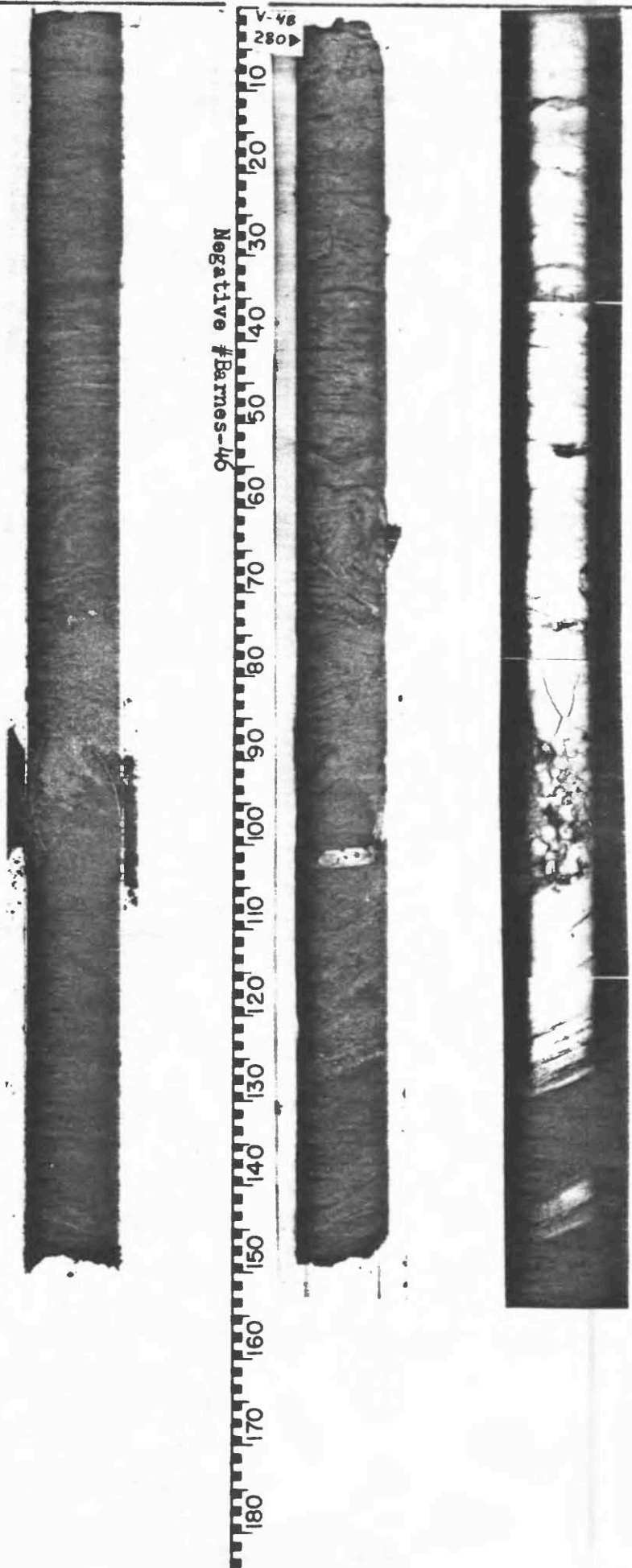
Gravelly sand as above (59-90 cm).

Contorted mixture of clean, fine sand, with scattered small pebbles. Very fine fibrous organic material mixed with small amounts of sandy silt which contains micro-bivalves and vase-like seeds (fresh water?) Sandy in upper part with almost pure peat at bottom, but segment has been worked almost to the top by cryoturbation or ice push.



Core V-49. Depth: 3 m. 70°32.44N, 149°30.7W, Remarks: South of Pingok Island

Core V-49



Sandy mud with ill-defined bedding, mottled or disturbed. A few sticks and fibrous organic matter several granule-size clasts. Finely laminated in upper 1-2 cm.

Well-bedded, sandy mud and fine to medium sand - small pockets of fibrous organic matter - the thin sand layers are poorly sorted - foraminifera present.

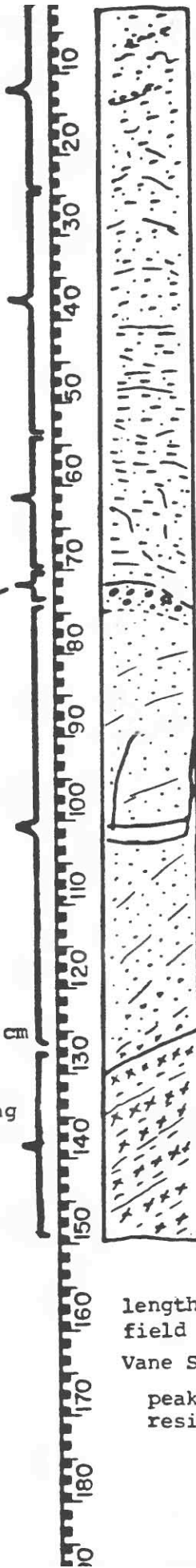
Highly disrupted sandy mud and fine to medium sand layers or lamina, with 1 cm thick layer of granule-size material at 56 cm (subrounded to angular clasts).

pebble-granule sand, maximum clast size - 8 mm.

Clean, medium to fine sand, finely laminated, oxidized in upper 20 cm (72-92 cm), dipping bedding due to coring snafu with core catcher breaking loose from core nose.

Pronounced smooth contact with 10 cm bed of upward coarsening fibrous organic matter, well-laminated. Gradational contact with underlying muddy medium sand. Well-bedded at 142 cm and second upward coarsening - fibrous organic unit with sand - well-bedded.

S. Naidu subsampled
1/2 of archive split
December, 1977



core catcher

small fragile bivalves -
increasing downward
subsample

fibrous organic matter
increasing in concentration
downward.

organic layer
sampled for C¹⁴

remainder of organic
layer sampled for
plant and animal
description

length measured in
field - 156 cm

Vane Shear -- Bottom

peak	5.9 knt/m ²
residual	2.3 knt/m ²

Core V-49, Depth: 3 m, 70°32.44N, 149°30.7W, Remarks: South of Pingok Island

Core V-

401 V-50

Negative # Barnes-47

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18

Core V-50, Depth: 1.4 m, 70°30.7N, 149°26.75W, Remarks: Just east of Milne Point

Core V-50

Finely-bedded to ripple-bedded, clean fine sand, few scattered pebbles up to 8 mm.

Below 30 cm, fine bedding is partially disrupted.

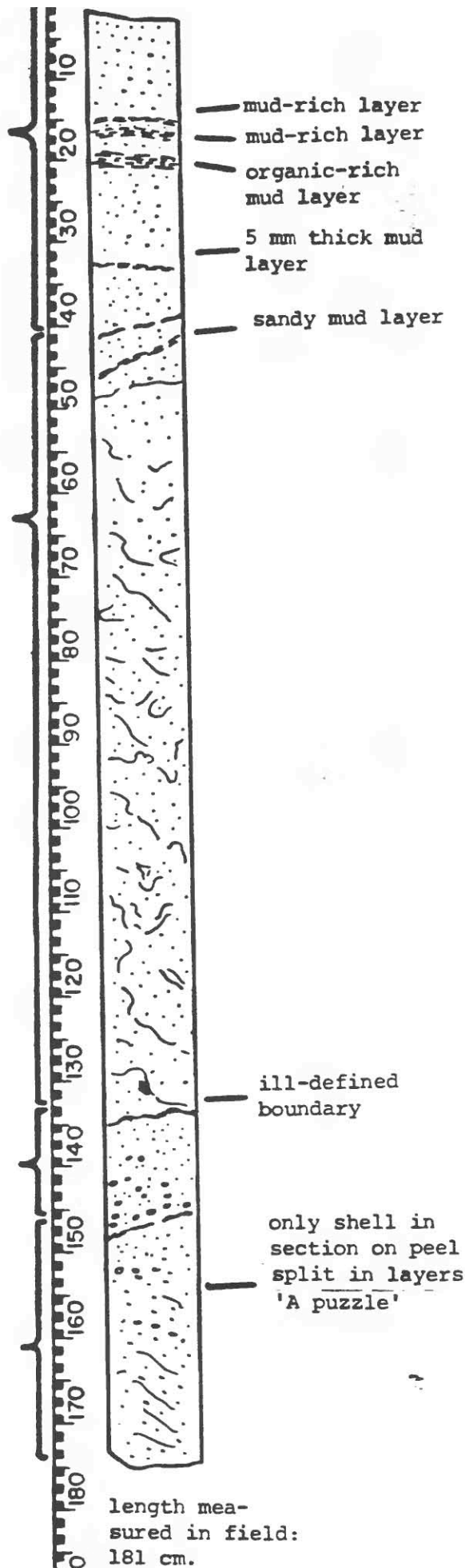
Physically disrupted, formerly finely bedded, clean fine sand and pebbly muddy sand, pebbles to 17 mm.

NOTE: Bedding contortions unlikely due to either hydraulic or biologic processes - but rather by a thorough physical mixing - blending clean sand with pebble muddy sand. Clean sand mixed to bottom of this section could be clean sand in upper 40 cm of core, pebbles could have been mixed upward from below.

Possibly a multi-keeled ridge or several "plow" events could have created structure

Unbedded gravelly sand - coarsening downward - clasts up to 40 mm. Some with frost split, but angular-subrounded.

Formerly finely-bedded to ripple-bedded poorly sorted medium sand, pebbly in upper 10 cm. Scattered granule clasts in lower part.



Negative # Barnes-48

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180

Core V-51, Depth: 2 m, 70°30.4N, 149°56.4W, Remarks: Off Oliktok to west

Core V-51

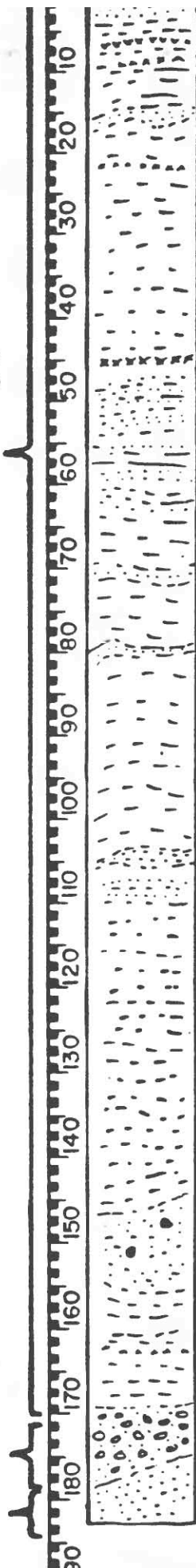
Laminated - horizontally bedded muddy fine sand with organic-rich layers up to 1 cm. A few fragile shell Cyrtodaria throughout section.

No pebbles in upper section (down to 146 cm).

Some sections up to 15 cm thick lack structure.

Clean, gravelly fine sand.

Clean, fine, laminated sand - few granules and pebbles - possible beach or spit.



laminated very fine sand
fibrous organic matter
very fine laminated clean sand

fibrous organic matter

very fine ripple-bedded sand

pebbly, sandy mud with few shells - no structure

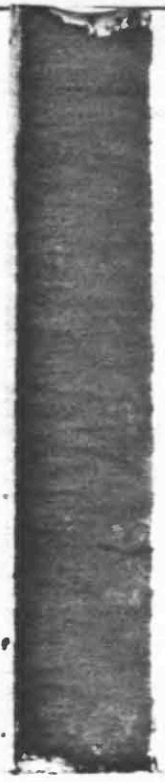
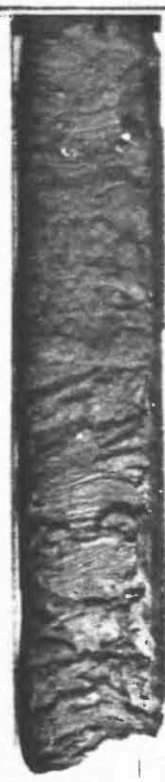
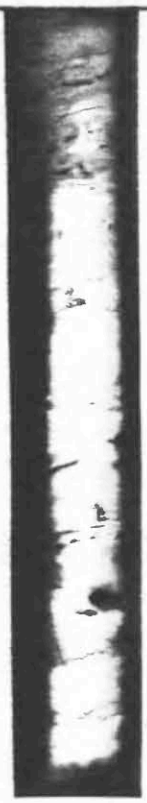
fibrous organic matter

Core V-51, Depth: 2 m, 70°30.4N, 149°56.4W, Remarks: Off Oliktok to west

Core V-51



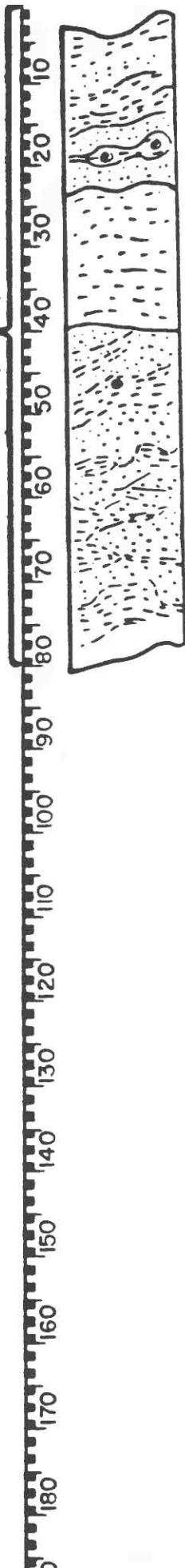
Negative #Barnes-49



Core V-52, Depth: 13 m, 70°36.69N 150°24.8W, Remarks: On test line 1 at inner shear line

Core V-52

Very similar to Core 54 with alternating beds of slightly sandy clayey mud with well laminated clean sand units and lenses, sands often have abundant mud lumps in lower sections. Upper mud units generally erosional and lower surfaces bioturbated.

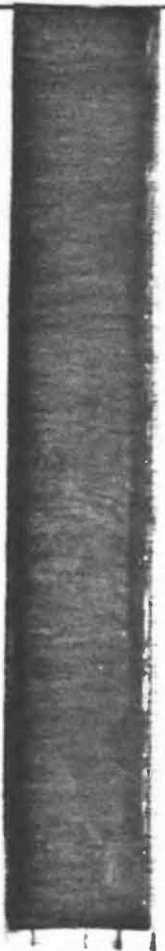
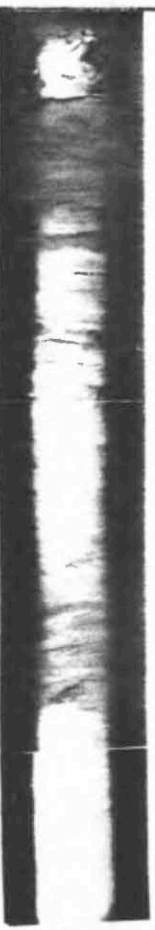


Comparison of 52, 53, and 54

- Remarkable similarity of sedimentary depositional units - mud units generally ripped up on surface and bioturbated at base.
- On washing peel, cut surface has pockets indicating mottling.
- No gradational contacts between sands and mud indicating an abrupt change in environment.
- Upper 3 cm disturbed but 53 and 54 different.
- No continuity of stratigraphy
- Mostly horizontal beds or laminations without indication of ice gouge disruption.

Negative #Barnes-50

01 02 03 04 05 09 04 08 09 00 01 02 03 04 05 09 01 02 08



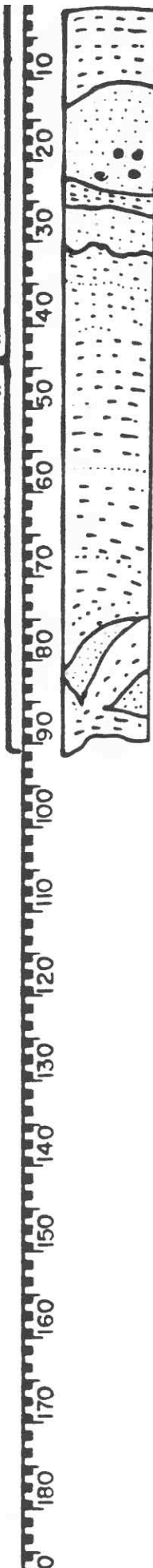
Core V-53, Depth: 13 m, 70°36.69N 150°24.8W, Remarks: 10 m east of V-52 along test line 1

Core V-53

Very similar to 54 with alternating beds of slightly sandy clay - muds and well-bedded and cross-bedded clean sand units and lenses.

See V-54 for detailed description of various sedimentary units. Also, see V-52 for comparison of the 3 core series.

In general remarkable similarity in type of sedimentary units with no continuity of stratigraphy from one core site to another.

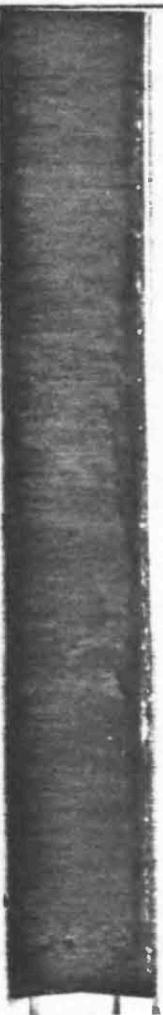


Core V-53, Depth: 13 m, 70°36.69N 150°24.8W, Rmks: 10 meter East of 52 along test line 1

V-5:



Negative # Barnes-51



10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180

shell fragments and worm tubes.

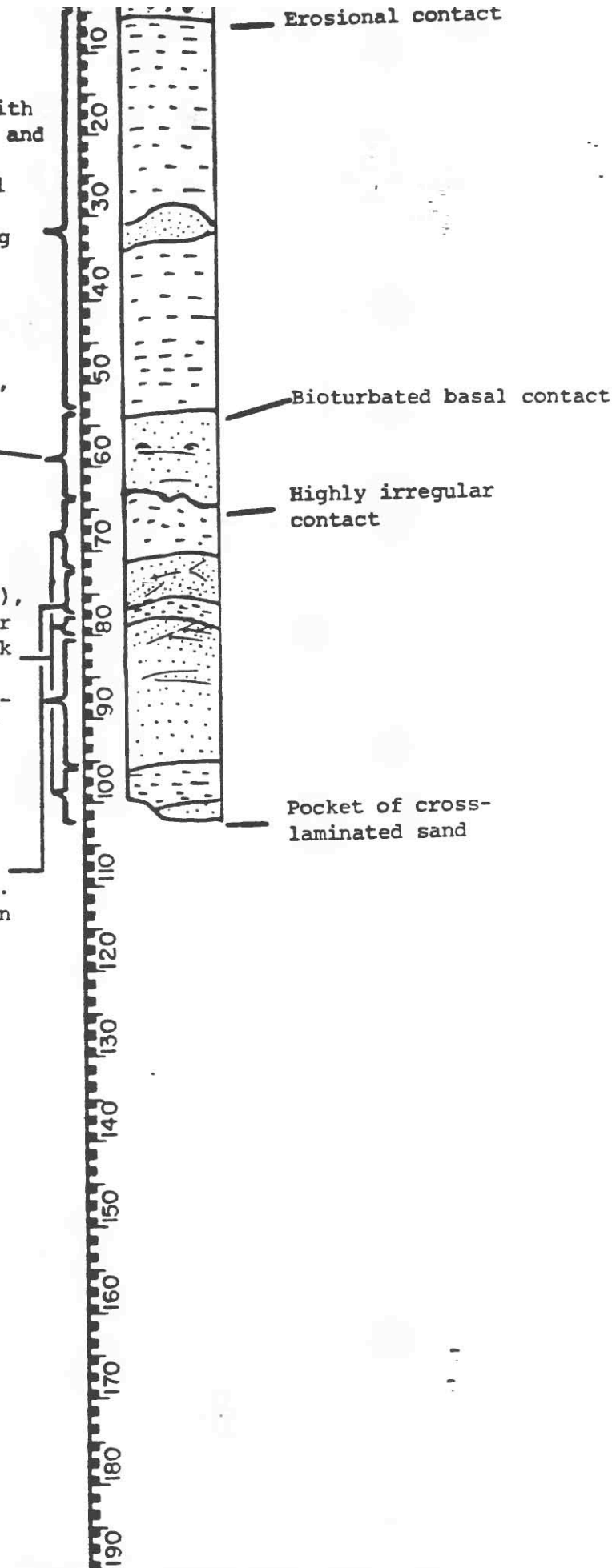
Cohesive slightly sandy clayey silt with several clean sand lenses and pockets and one 3 cm thick lens of clean, ripple-bedded fine sand. Few scattered small shell fragments. Granules throughout. Faint indication of horizontal bedding in muds - possibly cross-bedding at 50 cm.

Fine to medium horizontal to cross-laminated clean sands with small, fragile bivalves along bedding planes, convex side up, mud. Lump near base, basal laminations are smoothing over underlying mud surface, burrows from mud extend up to 3 cm into overlying sand.

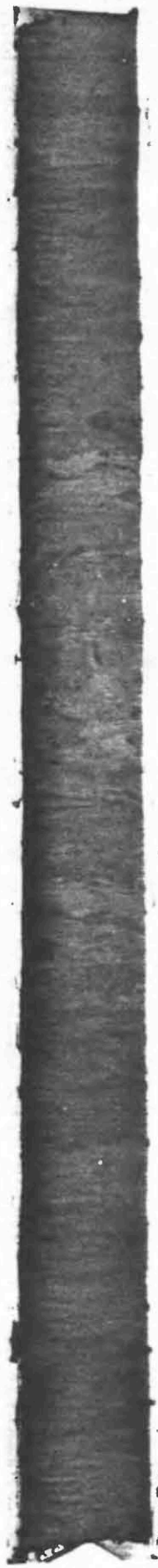
Very cohesive clayey silt beds, with shell material as above unit (5-53 cm), lacking internal structures except for basal unit which contains a 1 cm thick bed of cross-laminated sand. Upper surfaces of muds generally rough, probably erosional undersurfaces, either smooth or bioturbated.

Similar to sand unit between 53 and 64 cm.

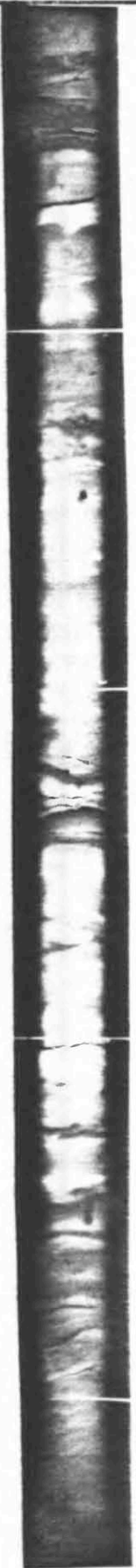
Cross-laminated medium sands except cross-laminations are more pronounced. Fewer shells and lacking worm tubes in upper layers.



FORM 1-66 7-6633 0000 1-6633 00 0-11-11



25-seureg# eaftege



Structurally complex - difficult to describe.

Light grey clayey silt with .5-6 cm thick fine sand layers interbedded. Sand units have fine bedding to cross bedding structures - upper and lower contacts ranging from smooth to highly irregular. Sands in upper part of core have burrows. Occasional shell fragments throughout core.

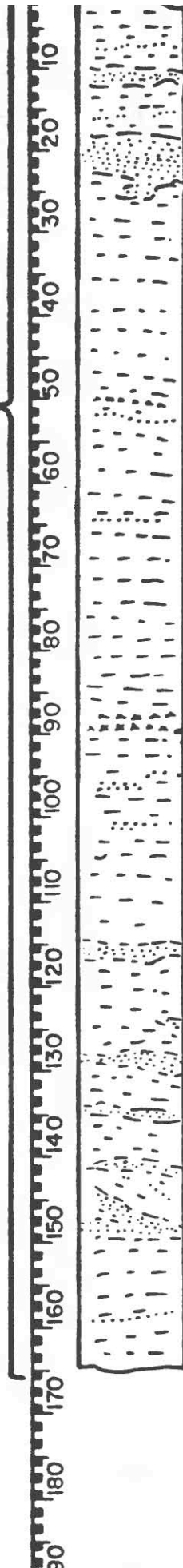
Clayey silt - shows a variety of known and unknown structures - from horizontal laminations - bioturbation, to physically disrupted and gouged. bioturbation clearly evident in upper 16 cm only.

Silt has numerous lenses of sands 1-3 cm thick.

Note: Mixture of ice and primary hydraulic structures - not at rate of ice gouge sediment reworking.

Why is bioturbation present only in upper part of core?

Parts of core reflect ice-related reworking and parts show well-preserved primary structures in both sands and silt units.



Organic rich layer at 89-91 cm. Whiskers of organic matter at 84 cm and 48 cm.

Sampled for organics

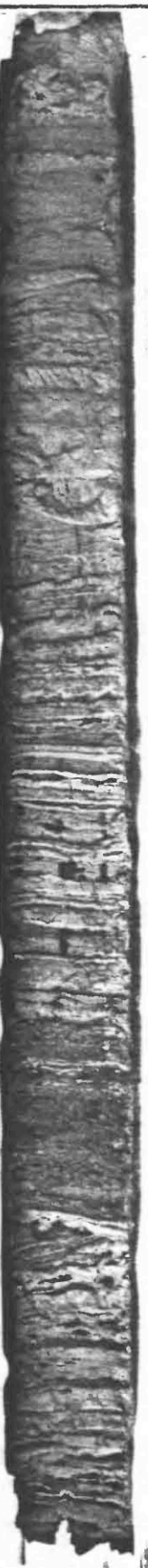
1 pebble - flat, 1.5 cm dia. at base of sand layer at 129 cm.

Vane Shear -- Bottom

peak >9.5 knt/m²
residual >9.5 knt/m²

Core V-55, Depth: 7 m, 70°33.88N 150°28.0W Rmks: Between V-17 and V-18 off Colville Delta

Core V



Negative # Barnes-53



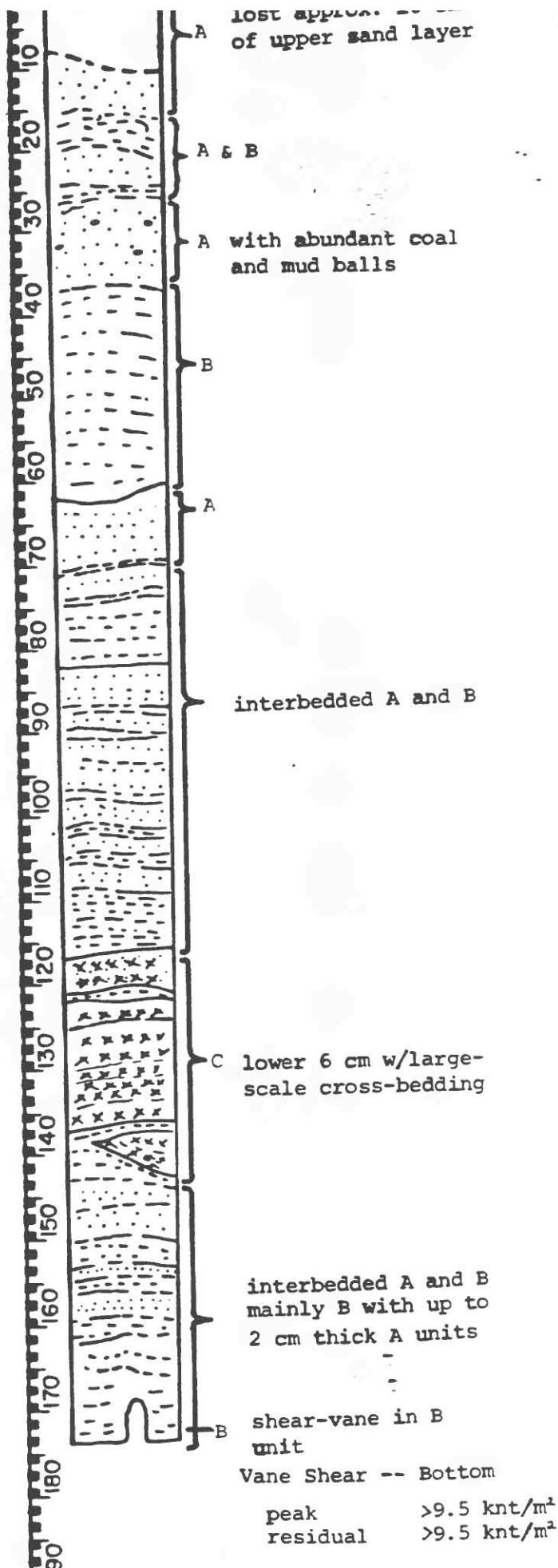
Description of units for cores 56,
57 and 58

A - sand unit - very fine to fine clean sands with well preserved primary structure: cross lamination and horizontal lamination, locally with black shiny fragments (coal) along bedding planes. Contain fibrous organic matter, Cyrtodaria fragments and mud balls. Lower contacts occasionally with rip-up structures, upper contacts generally sharp.

B - mud units - cohesive silty clay to clayey silt - locally with minor admixtures of fine sand, often with fibrous organic matter in laminar units 2-3 cm thick or as scattered organic fragments including sticks along bedding planes: muds are generally laminated as silty clays and clay silt units up to 4 cm. Cyrtodaria fragments present throughout units. Upper contacts rip-up. Lower contact generally sharp with sands. Very little evidence of burrowing. Washed peel faces commonly have pockmarks 1 - 10 mm suggesting grain size variations or differences.

C - peat - fine to coarse, horizontally laminated organic matter containing stems and sticks to 5 cm long, locally with less than 10% clastic detritus. Interbedded with mud layers up to 5 mm thick.

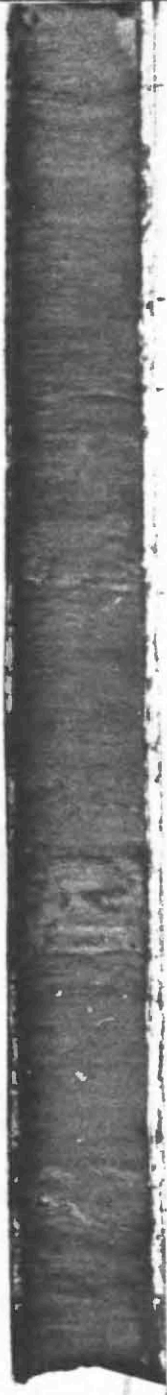
peel 2-3 cm short



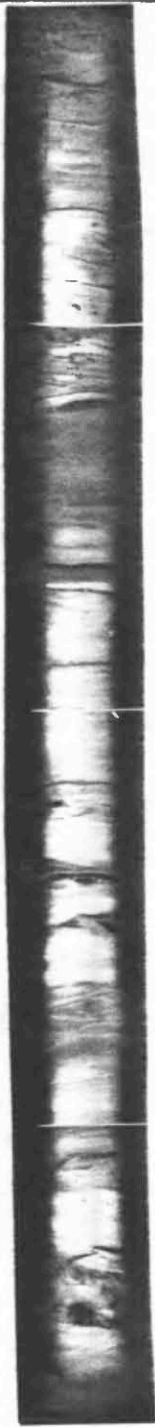
Core

Core V-56 70°32.4N, 150°28.4W, Depth: 2.5 m, Remarks: Central Colville Delta

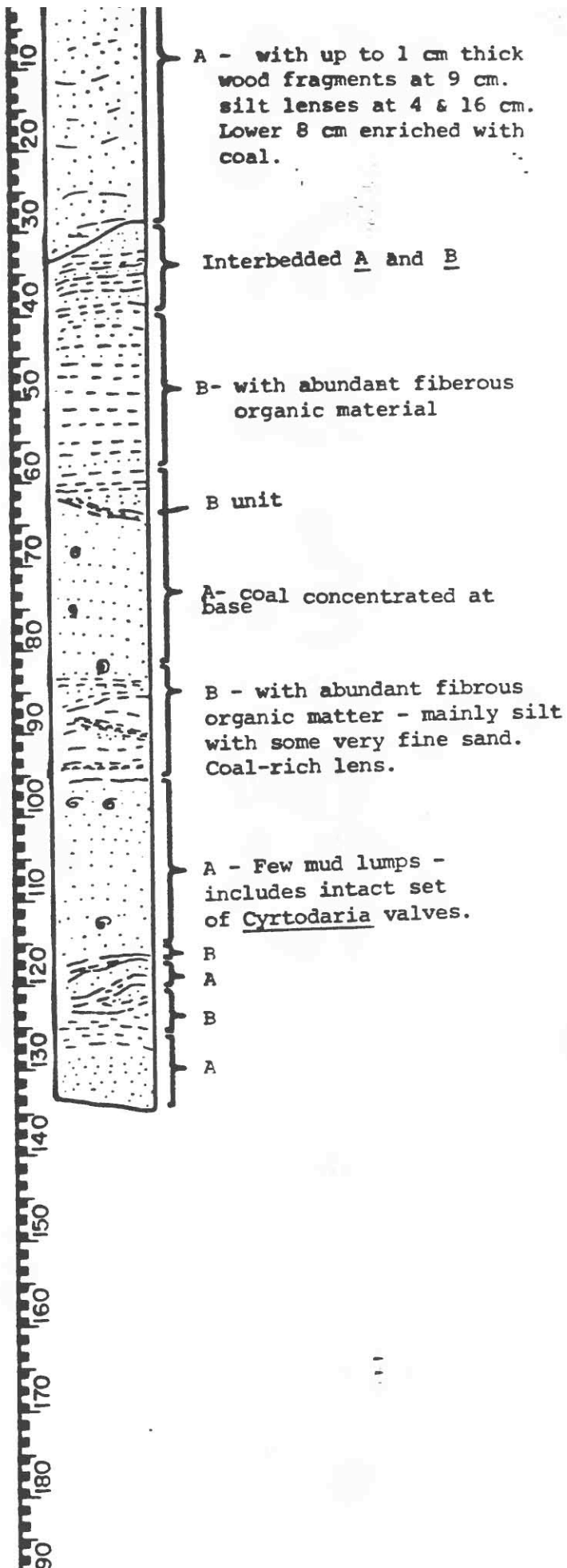
Core V-57
united lateral section
Colville Delta central section
50 m east of V-56
Barnes
NW 150028
NW 70033
20 m North
Core V-57 North



Negative # Barnes-54

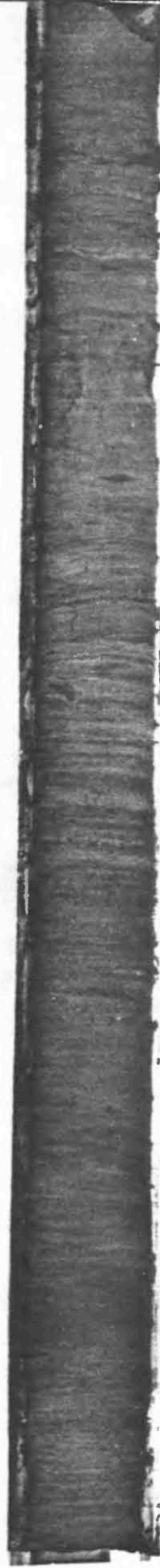


See Core V-56 for unit A, B & C descriptions.

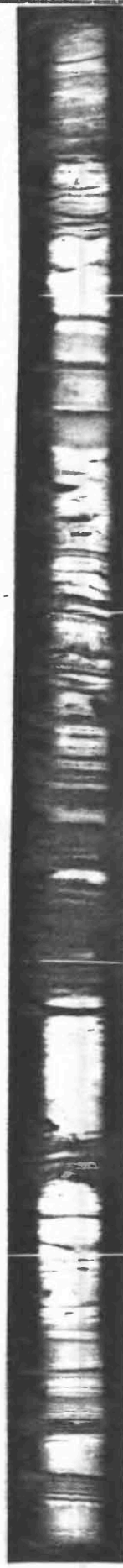


Core V-57, Depth: 2m, 70° 32.4N, 150° 28.4W, Remarks: 50 m east of V-56 Colville Delta central section

Core V



55-source negative



See Core V-56 for description of units A, B and C

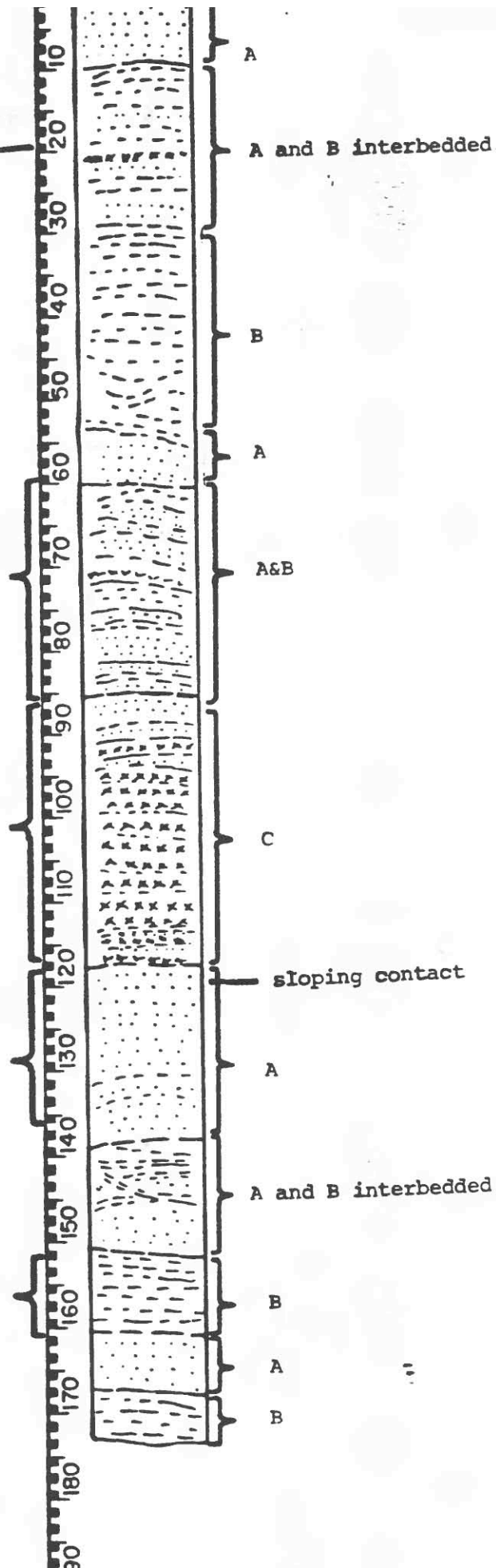
Very high concentration of coal at 18 cm.

Interbedded A and B with abundant organic matter in B

C - including two 1-cm A units in upper part and becoming clay-rich and crossbedded in lower part

A - with coal and mud balls along bedding planes - coal and fine fibrous organic matter in lower 7 cm.

B - with mud and organic matter in lower 2 cm.



Core V-58 70°32.4N, 150°28.4W, Depth: 2.0 m, Remarks: 50 m onshore from V-56 - south

Core V

Core V-59

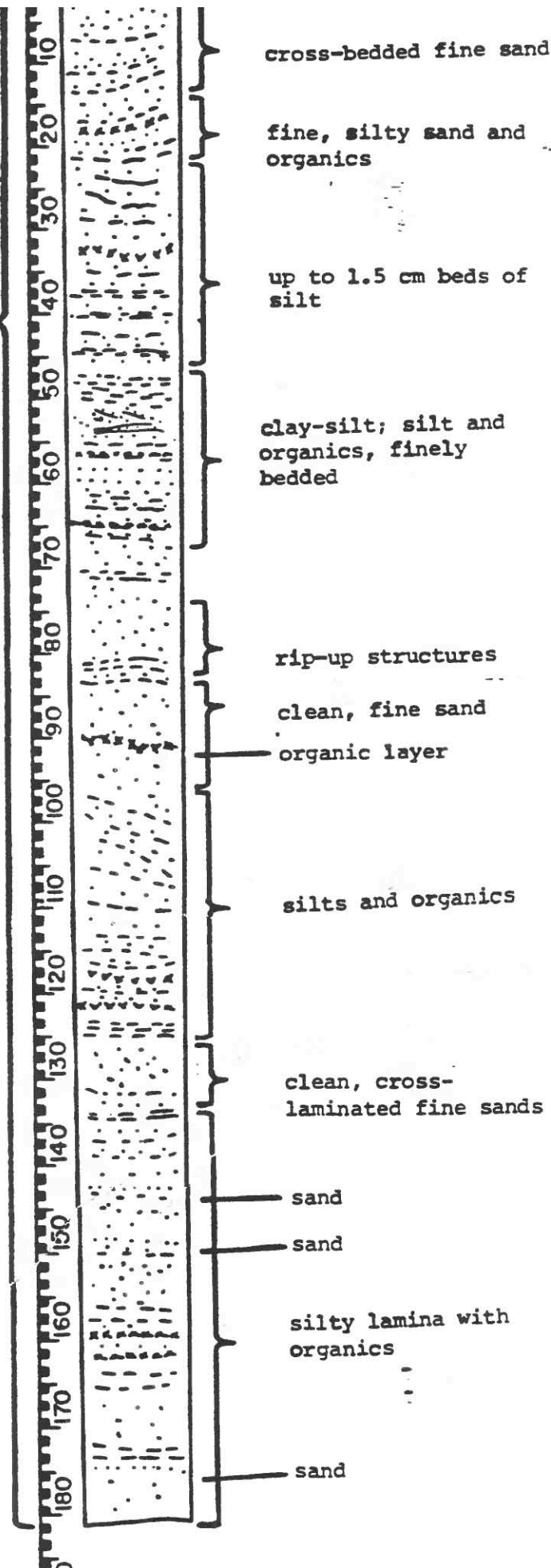
Negative #Barnes-56

V-59

Whole core description:

Interbedded sequence of clayey silt, very fine silty sand, thin-bedded fibrous organic matter, up to 8 cm thick units of clean fine sand, no shells, granules up to 4 mm at 153 cm. Generally sandier above 50 cm (less organics). Sands are mostly ripple-bedded whereas remainder of core is thinly laminated except 70-77 cm where structures are somewhat disrupted.

Note: Possibly dominant westerly dip to ripple bedding although ripple beds also dipping in opposite direction.



Core V-59

Core V-59 Depth: 1.3 m 70°27.68N 150°11.7W Remarks: Off E Colville Channel